CLS-420

420 Cargo Lift Scale

Version 1.15

Installation Manual

RICE LAKE®
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96483 Rev A

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1.0 Introduction

This manual is intended for use by individuals responsible for installing the CLS-420 Cargo Lift Scale along with the 420 digital weight indicator. This manual covers information on the installation and maintenance of the scale carriage, signal cable installation (if applicable), and the installation, configuration, and calibration of the 420 digital weight indicator.

While the functionality remains the same for a standard 420 digital weight indicator, there are certain menu choices in the configuration section of this manual specific to this application.

The *CLS-420 Operator Card*, PN 96484 included with this manual, provides basic operating instructions for users of the CLS-420 and the 420 indicator. Please leave the operator card with the indicator when installation and configuration is complete.

Manuals can be viewed or downloaded from the Rice Lake Weighing Systems website at **www.ricelake.com/manuals**

Warranty information can be found on the website at **www.ricelake.com/warranties**

1.1 Overview

The CLS-420 Cargo Lift Scale is a rugged, dependable cargo lift scale that can withstand many years of repeated use. When mounted on a forklift, the CLS-420 saves time and money by allowing you to weigh loads immediately instead of carrying the load to a floor scale.

The CLS-420 scale carriage comes in three different sizes including: 28 in, 34 in, 38 in.

The CLS-420 is used with Rice Lake's 420 digital weight indicator and setup and calibration of the indicator is discussed in detail in the following sections.

On board Features

Features of the basic cargo lift scale include:

- NTEP approved, Class III, 5,000 lb, 1:1000
- Class II forklift, with 16" cleat style carriage
- NTEP approved, Class III, 8,000 lb, 1:1000 (38 in only)
- Class III forklift with cleat style carriage (38 in only)
- Two (2) stainless steel load cells
- Mechanical overload protection
- Flexure plates with bolts welded into place
- Cover plate
- Welded centering pin
- View port
- Two-channel iQube®
- Wired or wireless communication

Figure 1-1. Fork Lift with CLS-420

1.3 Safety

Safety Symbol Definitions:

DANGER *Indicates an imminently hazardous situation that, if not avoided, will result in death or serious injury.*

WARNING *Indicates a potentially hazardous situation that, if not avoided could result in serious injury or death, and includes hazards that are exposed when guards are removed.*

CAUTION *Indicates a potentially hazardous situation that, if not avoided may result in minor or moderate injury.*

Important *Indicates information about procedures that, if not observed, could result in damage to equipment or corruption to and loss of data.*

General Safety

Do not operate or work on this equipment unless you have read and understand the instructions and warnings in this manual. Failure to follow the instructions or heed the warnings could result in injury or death. Contact any Rice Lake Weighing Systems dealer for replacement manuals. Proper care is your responsibility.

WARNING

Failure to heed may result in serious injury of death.

Some procedures described in this manual require work inside the indicator enclosure. These procedures are to be performed by qualified service personnel only.

Take all necessary safety precautions when installing the scale carriage including wearing safety shoes, protective eye wear, and using the proper tools.

DO NOT allow minors (children) or inexperienced persons to operate this unit.

DO NOT operate without all shields and guards in place.

DO NOT jump on the scale.

DO NOT use for purposes other then weight taking.

DO NOT place fingers into slots or possible pinch points.

DO NOT use any load bearing component that is worn beyond 5% of the original dimension.

DO NOT use this product if any of the components are cracked.

DO NOT exceed the rated load limit of the unit.

DO NOT make alterations or modifications to the unit.

DO NOT remove or obscure warning labels.

DO NOT use near water.

Keep hands, feet and loose clothing away from moving parts.

1.2 Considerations Before Installation

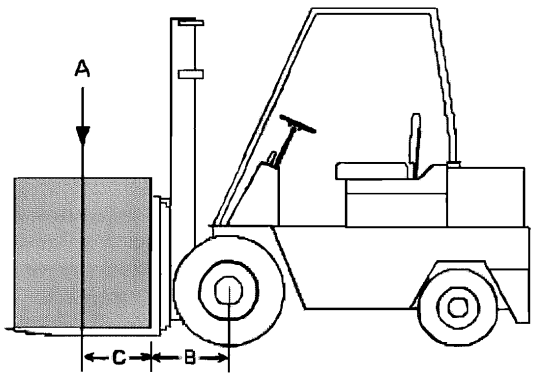
While the CLS-420 Cargo Lift Scale will fit most typical forklifts, there are certain considerations that must be taken into account prior to installing the scale. Due to the extra weight of the CLS-420, the net lifting capacity of the forklift scale is decreased by approximately 10%. Use the formula below to calculate the net capacity of the unit.

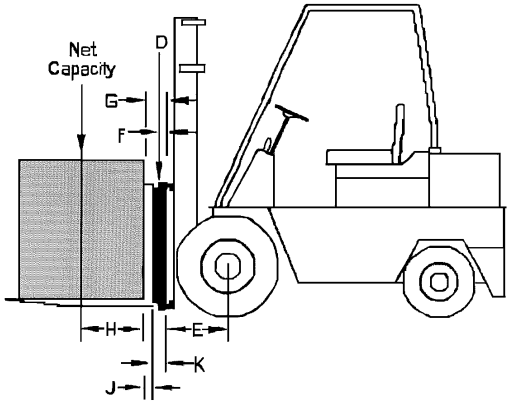
Note ***Formulas can give you a good estimate of how capacity will be affected. You should work closely with your forklift manufacturer before making a decision. Their data reflects, in most cases, testing with specific forklifts and attachments.***

$$\text{Net Capacity} = \frac{A(B + C) - D(E + F)}{E + G + H}$$

Where:

A = Truck basic capacity in pounds
B = Inches from the front wheel center line to fork face
C = Inches from the fork face to the truck rating point (usually 24")
D = Weight of the scale in pounds (*428 lbs*)
E = Inches from the front wheel center line to the carriage face
F = Inches from the carriage face to scale Horizontal Center of Gravity (HCG)
G = J + K (inches from the carriage face to the rear fact of load)
H = Inches from fork face to new truck rating point
J = Thickness of fork
K = Thickness of scale





CAUTION ***Another consideration is the indicator power source will be connected directly to the battery of the forklift. Most typical is 12 volts for propane, gas and diesel forklifts. However, some diesel forklifts are 24 volts.***

12 and 48 volt systems must have a negative ground so ensure the forklift has a negative ground electrical system. The CLS Series Cargo Lift Scale will not operate on a positive ground forklift. Refer to the forklift users manual to further verify grounding requirements.

1.2.1 CLS Classes and ID Plates

During the initial sale and installation of the CLS-420, you need to remind your customer that they must have an ID plate on their forklift updated stating the new lifting capacity and center of gravity information. This requirement is per OSHA rules and regulations.

1.3 420 Digital Indicator

The 420 is a single-channel serial weight indicator housed in a NEMA 4X/IP66-rated stainless steel enclosure. The indicator front panel consists of a large (1.8 in, 44.5 mm), six-digit, seven-segment LED display and 21 button keypad.

Features of the standard CLS-420 include:

- Two configurable digital inputs and two configurable outputs
- Electronic data processing (EDP) port dedicated to communication with the two-channel iQube in forklift applications.
- Printer port for full duplex RS-232 or active transmit only 20 mA current loop communications at up to 38400 bps
- NTEP certified
- 9-36 VDC input - VDC range of new power supply
- The setpoint key on the indicator can be used for wireless versions to display battery hours remaining.

1.3.1 Front Panel

Figure 1-2 shows the 420 LED annunicators, keypad, and normal mode key functions.

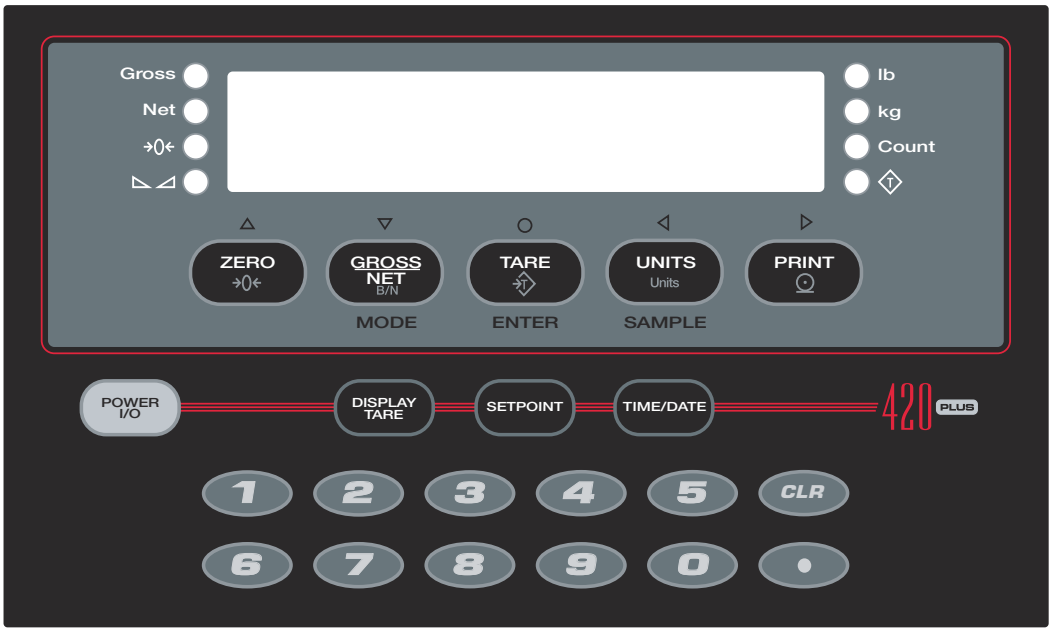


Figure 1-2. 420 Front Panel, Showing LED Annunicators and Normal Mode Key Functions

The symbols shown above the keys (representing up, down, enter, left, right), describe the key functions assigned in setup mode. In setup mode, the keys are used to navigate through menus, select digits within numeric values and increment/decrement values.

The 420 also has a **Power** key. Use the **Power** key to turn the indicator on or off.

WARNING ***The 420 has an off/off switch for the processor functions. Before opening the unit, ensure the 420 is disconnected from the forklift battery power source.***

1.3.2 LED Annunicators

The 420 display uses a set of six LED annunicators to provide additional information about the value being displayed:

- *Gross* and *Net* annunciators are lit to show whether the displayed weight is a gross or net weight.
- Center of zero (→0←): Gross weight is within 0.25 graduations of zero. This annunciator lights when the scale is zeroed.
- Standstill (◺ ◿): Scale is at standstill or within the specified motion band. Some operations, including tare functions and printing, can only be done when the standstill symbol is shown.
- *lb* and *kg* annunciators indicate the units associated with the displayed value: lb=pounds, kg=kilograms.

  The displayed units can also be set to short tons (tn), metric tons (t), ounces (oz), grams (g), or NONE (no units information displayed). The *lb* and *kg* LEDs function as primary and secondary units annunciators for some combinations of primary and secondary units. If neither primary nor secondary units are lb or kg the *lb* annunciator is lit for primary units, *kg* for secondary units.

Table 1-1 shows which annunciators are used for all combinations of configured primary and secondary units. For example:

- If the primary unit is pounds (lb) and the secondary unit is kilograms (kg), the *lb* LED is lit for primary units, *kg* for secondary units.
- If the primary unit is pounds (lb) and the secondary unit is short tons (tn), the *lb* LED is lit for primary units, *kg* for secondary units. There is not an LED for short tons, so the *kg* LED is used as the secondary units annunciator.
- If the primary unit is short tons (tn) and the secondary unit is pounds (lb), the *lb* LED is lit for primary units (tn), and *kg* is lit for secondary units (lb). Because there is no LED for short tons, the *lb* and *kg* LEDs are used as primary and secondary units annunciators.

Primary Unit	Secondary Unit						
	lb	kg	oz	g	tn	t	none
lb	lb / lb	lb / kg	lb / oz	lb / g	lb / kg		
kg	kg / lb	kg / kg	kg / oz	kg / g	lb / kg		
oz	oz / lb	oz / kg	oz / oz	oz / g	oz / kg		
g	g / lb	g / kg	g / oz	g / g	g / kg		
tn	lb / kg	lb / kg	lb / oz	lb / g	lb / lb	lb / kg	lb / kg
t					lb / kg	lb / lb	lb / kg
none					lb / kg	lb / kg	lb / lb

Table 1-1. Units Annunciators, Showing Primary / Secondary LEDs Used for All Configurations

1.3.3 Indicator Operations

Basic 420 operations are summarized below.

Toggle Gross/Net Mode

Press the **GROSS/NET** key to switch the display mode from gross to net, or from net to gross. If a tare value has been entered or acquired, the net value is the gross weight minus the tare.

Gross mode is shown by the *Gross* annunciator; net mode is shown by the *Net* annunciator.

Toggle Units

Press the **UNITS** key to switch between primary and secondary units. The appropriate units LED under the display is lit.

Zero Scale

1. In gross mode, remove all weight from the scale and wait for the standstill annunciator (◺ ◿).
2. Press the **ZERO** key. The center of zero (→0←) annunciator lights to indicate the scale is zeroed.

Acquire Tare

1. Place container on scale and wait for the standstill annunciator (◺ ◿).
2. Press the **TARE** key to acquire the tare weight of the container. Net weight is displayed and net annunciator is lit.

Remove Stored Tare Value

1. Remove all weight from the scale and wait for the standstill annunicator.
2. Press the **TARE** key. The Gross annunicator is lit.

Set Date

In the front panel setup mode, use the arrow keys to toggle to *DATE*. Press the **Down** arrow or **Enter** to enter the date in the format configured for the indicator.

Set Time

In the front panel setup mode, use the arrow keys to toggle to *TIME*. Press the **Down** arrow or **Enter** to enter the time in 24-hour format, then press the **Enter** key to save that value.

Display Accumulator

Hold the **(MODE) GROSS/NET** key for three seconds to display the accumulated valued if enabled in configuration. The accumulated value will be displayed for about 10 seconds. To clear the accumulator, press the **CLR** key twice while the accumulated value is being displayed.

1.3.4 Modes of Operation

The 420 has four modes of operation:

Normal (Primary) mode

Normal mode is the "default" mode of the indicator. The indicator displays gross or net weights as required, using the LED annunciators described in Section 1.3.2 on page 5 to indicate scale status and the type of weight value displayed. Once configuration is complete and a legal seal is affixed to the back of the indicator, this is the primary mode in which the 420 can operate.

Setup mode

Most of the procedures described in this manual require the indicator to be in setup mode, including configuration and calibration.

To enter setup mode, remove the setup screw and insert a small screwdriver pressing the setup switch once. The indicator display changes to show the word *CONFIG*.

Test mode

Test mode provides a number of diagnostic functions for the 420 indicator. Like setup mode, test mode is entered using the setup switch. See Section 8.9 on page 49 for more information about entering and using test mode.

NOTE: Test mode is intended for factory and technician use only.

Front Panel Setup Mode

Hold the **UNITS** key for three seconds to enter front panel setup mode. Use front panel setup to change setpoint and to set the time and date.

Note ***This can be done without breaking the seal.***

1.4 Accepting Weight Data to the Indicator

The 420 indicator can accept data in two different ways from the two-channel iQube and depending upon which version is purchased, will come with different components. They are:

- Wired - coil cable

Figure 1-3. Coil Wired Signal Cable That Runs Between the Indicator and the Two-Channel iQube

- Wireless - attached onto the back of the 420 indicator and collects data from the two-channel iQube without the use of a coil wire cable. The two-channel iQube uses a lithium-ion battery which is housed on the scale.

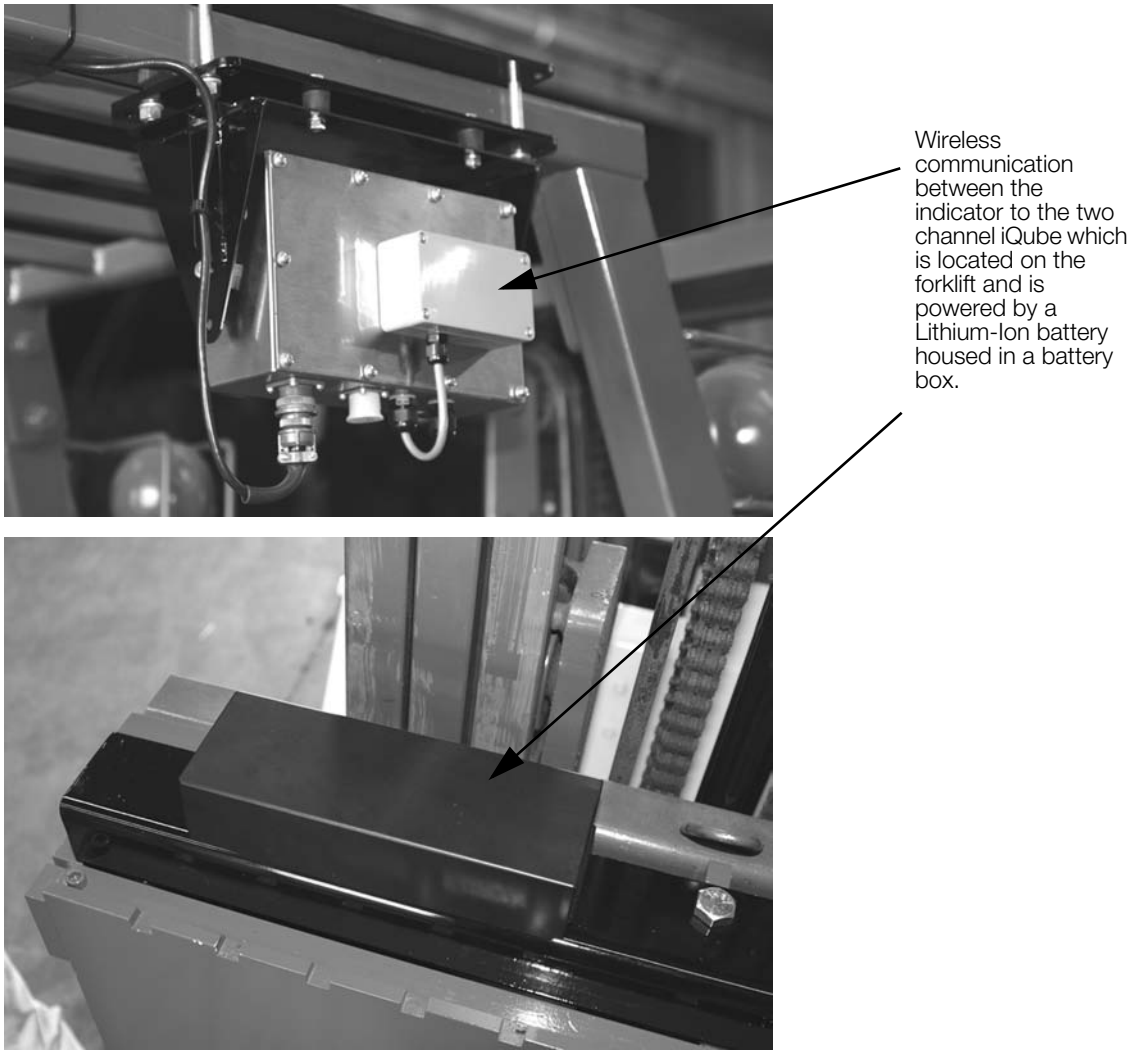

Wireless communication between the indicator to the two channel iQube which is located on the forklift and is powered by a Lithium-Ion battery housed in a battery box.

Figure 1-4. Wireless Version of Communication

2.0 Scale Base Installation

This section describes procedures for installing the CLS-420 scale base.

WARNING ***Take all necessary safety precautions when installing the scale carriage, including wearing safety shoes and protective eyewear, and using the proper tools which are listed in Section 2.3.***

The CLS-420 Cargo Lift Scale is shipped from the factory with the scale already calibrated to the indicator. Minimal recalibration and adjustments might be necessary once the scale is installed onto the fork lift. Those calibration steps are contained in Section 6.1.

2.1 Unpacking

The CLS-420 Cargo Lift Scale is shipped upright on a sealed pallet as shown in Figure 2-1.

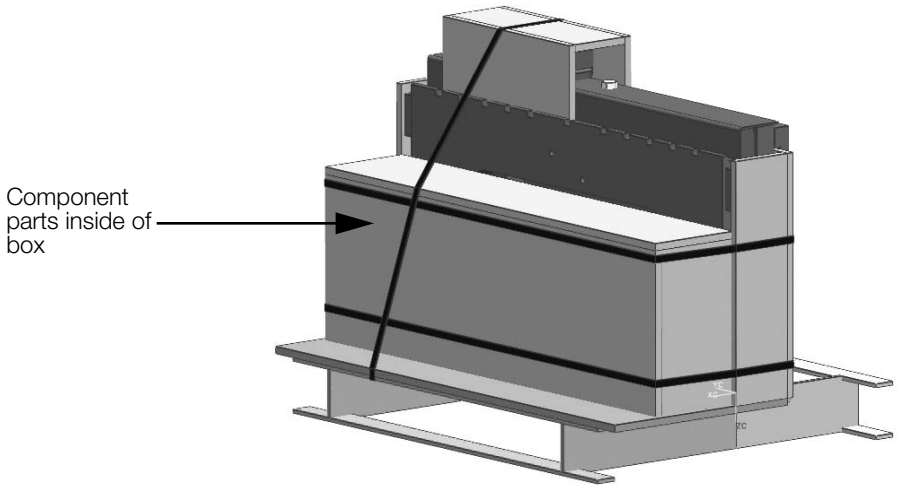


Figure 2-1. CLS-420 Packaging

Upon receipt of the shipping pallet, inspect it for any visible signs of damage. Immediately after unpacking, visually inspect the contents to ensure all components are included and undamaged. The shipping pallet should contain the following:

- One (1) scale carriage assembly with cover plate
- Indicator component box which includes:
  - One (1) electronic indicator with mounting bracket and hardware
  - One (1) power cable
  - CLS-420 Cargo Lift Scale installation manual
- Hardware Component Box which includes:
  - Two (2) cleats with four bolts
  - Cage clamp mounting assembly and hardware
  - One (1) coiled interface cable (for the wired version)
  - Two (2) lithium-ion batteries (for the wireless version)
  - Two-bay battery charger (for the wireless version)

Note ***To ensure that all products received from the manufacturer are in good shape upon arrival, it is recommended to fully inspect all contents and properly fill out the bill of lading.***

If any parts were damaged in shipment, notify the shipper immediately.

2.2 Before Installation

Before installing the CLS-420 on a forklift, the forklift should be in good operating condition in order to get the optimal amount of weighing accuracy. The following items are things to look for prior to installing the CLS-420 onto a forklift:

- Inspect the forklift tines for any damage.
- Check the locking pin on the forks for proper function.
- Check and adjust the lift chain so the heel of the forks have 1/2" to 1" of clearance from the floor when the carriage is down and the mast is vertical.
- The slot for the center pin should be clear of grease and debris.
- The top cleats of the forklift rest on the top of the scale and should remain clear of grease and debris that could alter the scales' performance.

It should be noted that while Rice Lake's CLS-420 will fit most typical forklifts, some considerations must be noted. The height of the carriage, width of the carriage inside of the guards, if applicable and voltage of the fork truck must be taken into consideration.

The indicator will be connected directly to the battery of the fork truck. Ensure the type and style of fork truck and the type of power it provides will be compatible with the indicator. Most propane, gas, and diesel fueled fork trucks provide 12 volts of power. Some diesel models also provide 24 volts and electric fork trucks provide 36 to 48 volts of power. The CLS-series scales work with 12-36 VDC power source.

Important ***All systems must have a negative ground.***

2.3 Tools Needed to Install the CLS-420 Onto the Fork Truck or Mobile Lift

Once the forklift is deemed in good mechanical and operating condition, you'll need the following tools to remove it from its shipping pallet and install onto the forklift.

Tool	Size	Purpose of Tool
Socket wrench	3/4"	To unbolt the fastening bolts holding the scale to the pallet and to open the top cover plate for wired versions
Allen wrench	1/2"	To bolt and unbolt the bottom cleats of the scale
Wrench - 2" adjustable	1-1/2"* 1-5/8"*	For adjusting the shim bolts and jam nuts *Note: Use a 2" adjustable as both the shim bolts and jam nuts are painted and a smaller wrench wouldn't fit.
Tin snips or band cutters		To cut the metal banding surrounding the CLS while on the pallet
Torque wrench w/ 1/2" Allen	1/2"	To tighten the cleats to 125 ft-lbs
Electric Grinder - if necessary		For grinding the center pin if necessary

Table 2-1. Recommended Tools for Unpacking the CLS-420

2.4 Scale Base Installation

The scale and indicator are shipped in an upright position as illustrated in Figure 2-2 and are enclosed in a protective wood cover. The upright position allows for ease of installation, especially if one person is installing the scale.

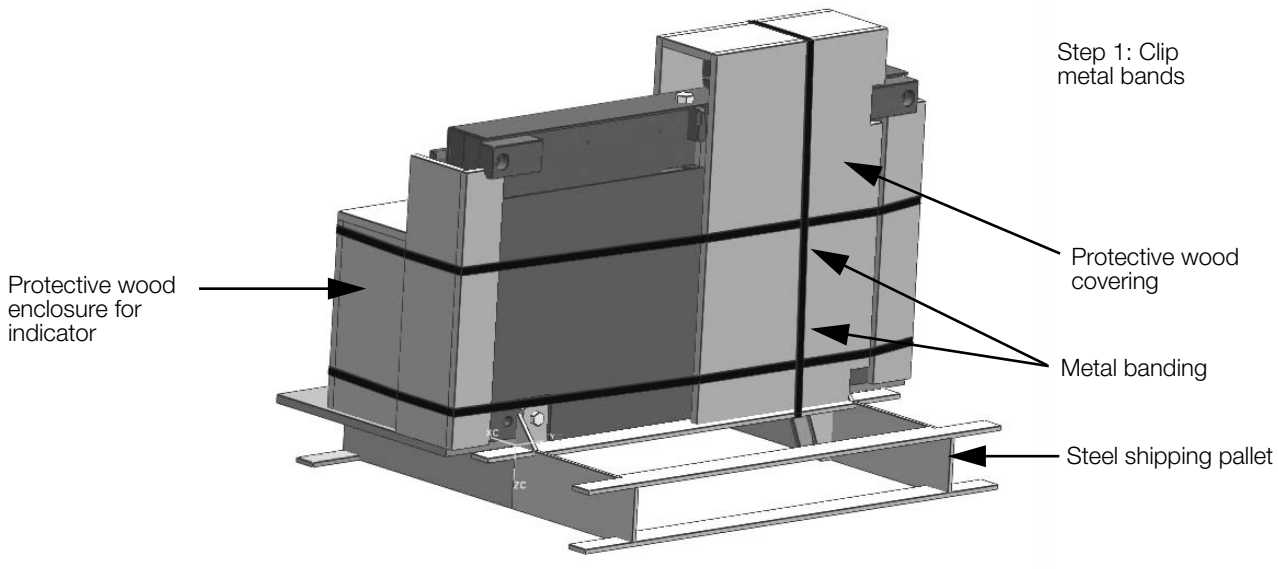


Figure 2-2. Scale Component Parts on Shipping Pallet

Use the following steps to install the scale base to the fork lift.

1. Clip the three metal bands that are encircling the scale and component box on the backside of the pallet (shown in Figure 2-2) and also remove the protective wood pieces which protect the sides of the scale.
2. Remove the wooden cover containing the indicator. It should be noted that there are two screws holding the indicator to the shipping pallet. Back those two screws out to remove the indicator.
3. Loosen the bolts from the scale carriage assembly and back them out using a 3/4" socket wrench. The nuts holding the bolts on the backside of the scale are welded onto the scale which requires the use of only one socket wrench. **This is what holds the scale in an upright position**.

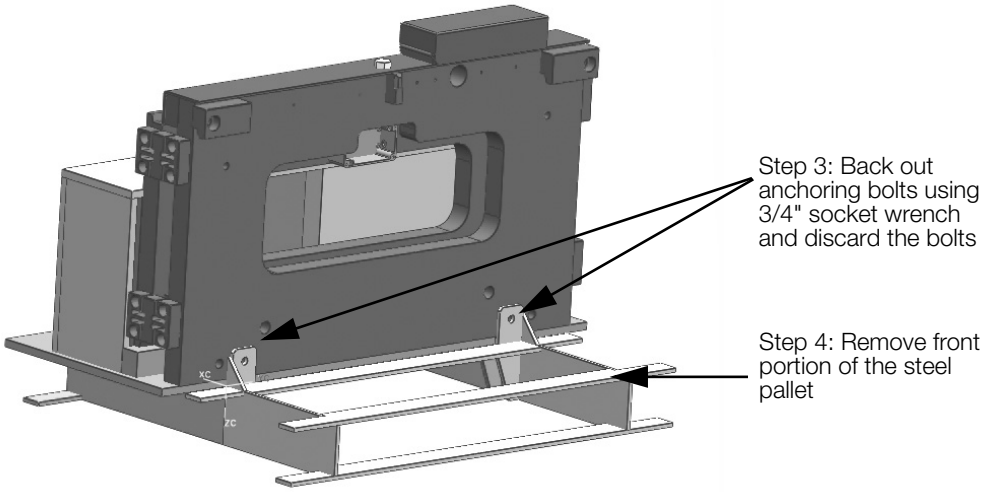

Step 3: Back out anchoring bolts using 3/4" socket wrench and discard the bolts
Step 4: Remove front portion of the steel pallet

Figure 2-3. Bolt Location on Pallet

4. Remove the front portion of the steel pallet that the scale is sitting on. It will break away from the rest of the pallet.

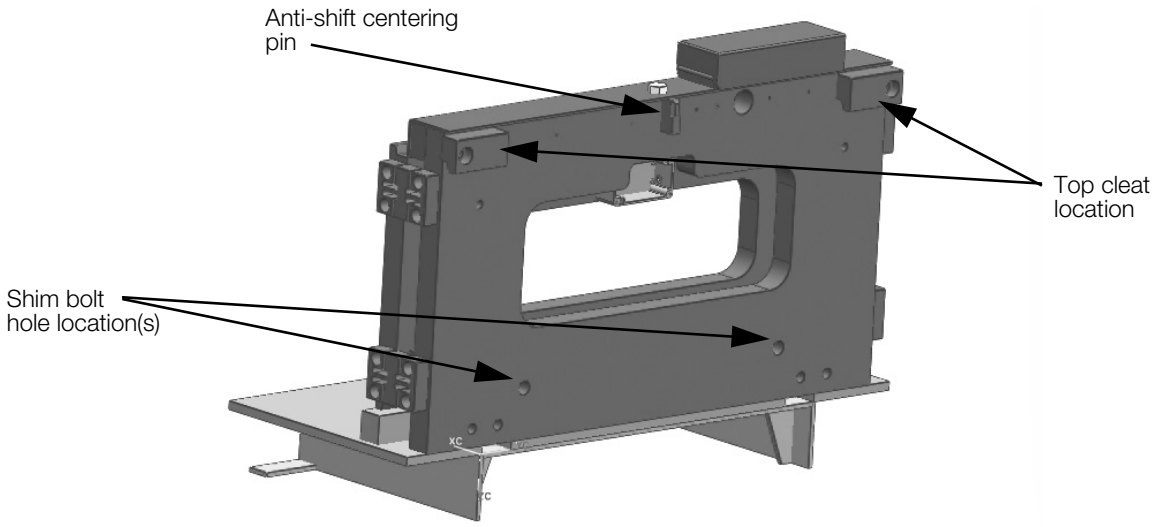


Figure 2-4. Removal of Steel Pallet and Top Cleat Location

5. Verify that the shim bolts are flush with the back plate of the scale. Not doing so will place the entire scale out of alignment when attaching it onto the forklift and will make it difficult to make final adjustments once the scale is mounted to the forklift.
6. Seal the two-channel iQube if it is to be used in Legal-For-Trade applications.
7. Making sure the forklift tines are removed from the forklift, move the forklift in close to the pallet and scale.
8. Carefully and slowly raise the scale carriage slightly so the top cleats (cleat location shown in Figure 2-4) of the scale hook onto the forklift carriage.
9. Ensure the anti-shift centering pin on the scale assembly is aligned with the center notch on the forklift carriage.

Note ***The scale's centering pin should be aligned with the middle notch of the truck carriage. Verify that the centering pin is adjusted so that the pin is located well within the center notch area of the carriage. The centering pin should not touch the bottom of the notch on the original carriage, as this will cause side to side tilting of the scale. The outside top cleats provide support to the scale assembly and the centering pin only helps to position the scale on the forklift carriage. The centering pin should not bear any weight. If it does, the use of a grinder to grind down the centering pin will help remedy that.***

10. Tilt the mast forward to catch the scale assembly and carefully raise the carriage to a comfortable working position.
11. Attach the bottom cleats to the bottom of the scale assembly (see Figure 2-5), so that the lip of the cleat is behind the scale carriage.
12. Torque the bottom cleat retaining bolts to 125 ft-lbs (shown in Figure 2-5 for bottom cleat location).

WARNING ***Failure to properly torque the bottom plate retaining bolts may result in bodily harm or damage to equipment.***

13. Next, adjust the shim bolts so that they are adjusted for minimal clearance between the bottom cleats and the scale carriage. This clearance needs to be .020 inch thickness and can be measured by using a feeler gauge.

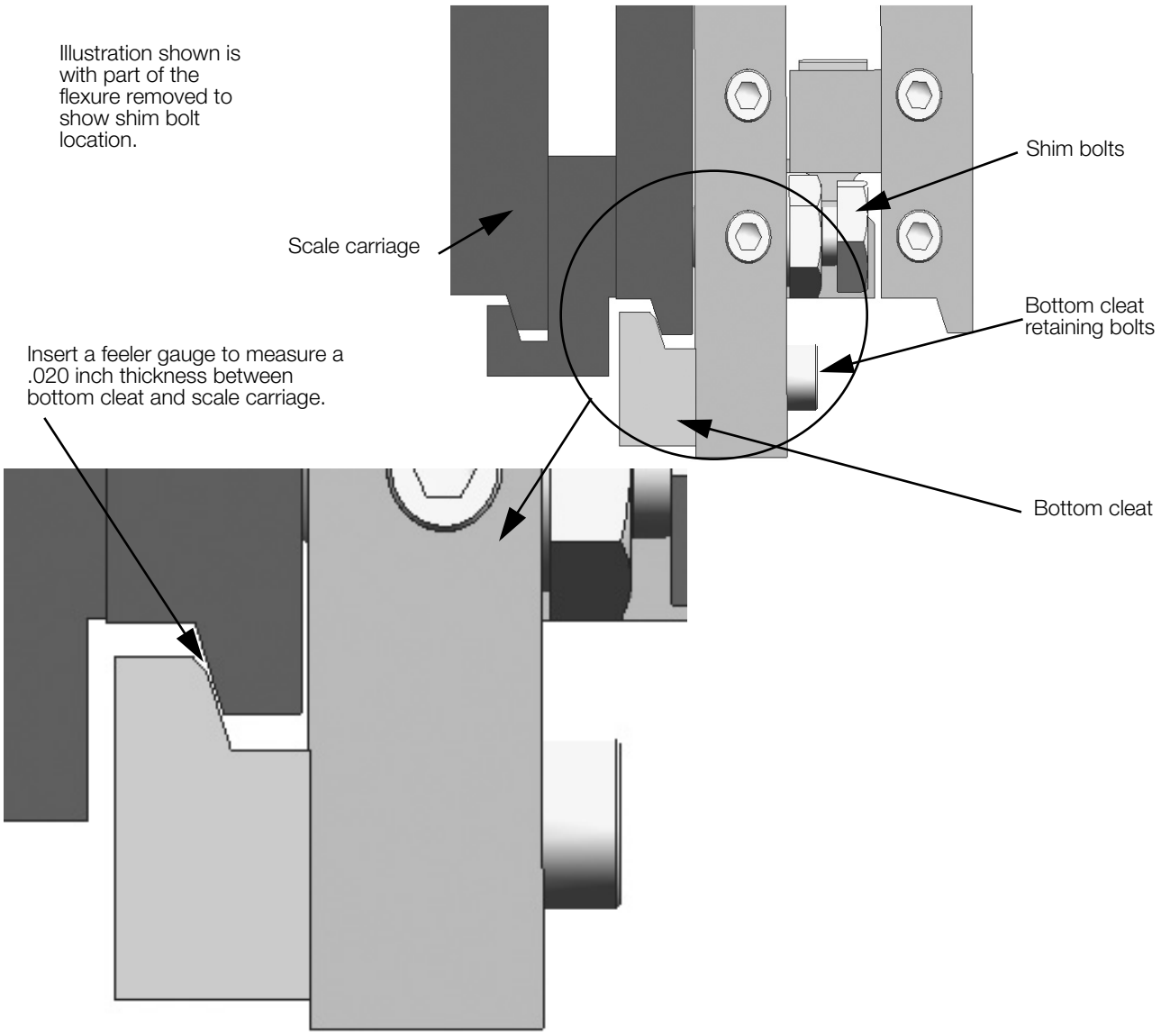


Illustration shown is with part of the flexure removed to show shim bolt location.
Shim bolts
Scale carriage
Bottom cleat retaining bolts
Insert a feeler gauge to measure a .020 inch thickness between bottom cleat and scale carriage.
Bottom cleat

Figure 2-5. Bottom Cleat Location and Assembly

14. Now reattach the forklift tines to the scale assembly by attaching them in the center of the scale and sliding them off to the sides.

3.0 Indicator Hardware Setup

3.1 Mounting the 420 Indicator

Location of the indicator is a matter of operator preference and should be installed in a location that allows for free vision.

The universal mounting bracket which is included (shown in Figure 3-1), enables the indicator to be mounted to the safety cage using the supplied hardware.

Figure 3-1. CLS Mounting Bracket

The indicator tilt position is adjustable by using a wrench so you can pick the best viewing angle for the operator.

Vibration isolators are also included in the supplied mounting bracket hardware. This cushions the indicator from vibration. These vibration isolators are shown below.

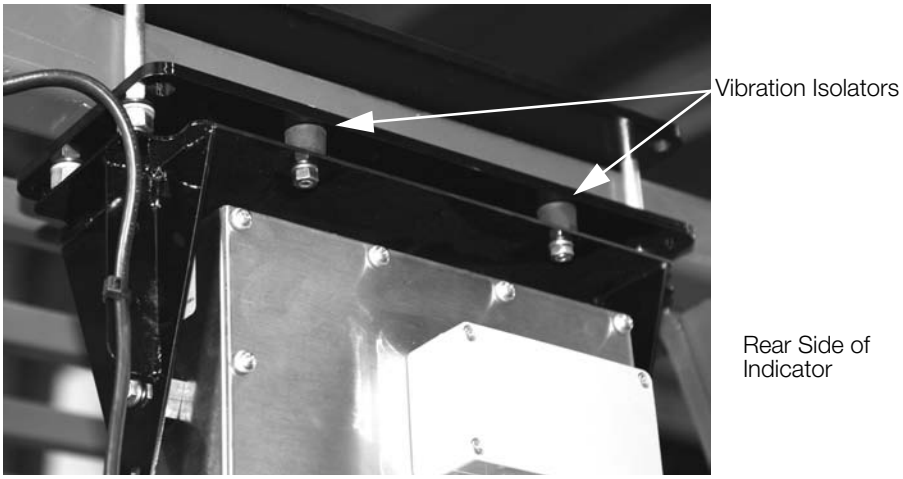


Figure 3-2. Vibration Isolator Control Location

To permanently lock the indicator mounting bolts, Rice Lake Weighing Systems recommends using Locktite 262

3.2 Cable Connections

The 420 indicator provides two cord grips and two MIL-C connectors for cabling into the indicator: The free cord grip comes with a plug installed to prevent moisture from entering the enclosure.

Figure 3-3 shows the assignments for the 420 cord grips.

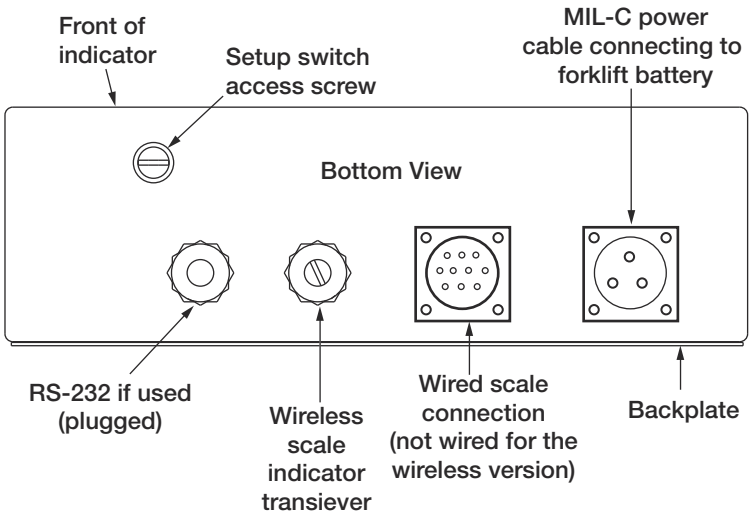

Front of indicator
Setup switch access screw
MIL-C power cable connecting to forklift battery
Bottom View
RS-232 if used (plugged)
Wireless scale indicator transiever
Wired scale connection (not wired for the wireless version)
Backplate

Figure 3-3. 420 Rear of Indicator

3.3 Supplying Power to the Indicator From the Forklift Battery

CAUTION ***The indicator power source will be connected directly to the battery of the forklift. Most typical is 12 volts for propane, gas and diesel forklifts. However, some diesel forklifts are 24 volts.***

12 and 48 volt systems must have a negative ground so ensure the forklift has a negative ground electrical system. The CLS series cargo lift scale will not operate on a positive ground forklift.

Refer to the forklift user's manual for further verify grounding requirements.

The indicator draws its power from the forklift battery. After the indicator is mounted, run the power cable along the forklift chassis down to the forklift battery.

Figure 3-4. Run Power Cable to the Forklift Battery

Note ***DO NOT plug in the power connector into the bottom of the indicator until power hookup is completed.***

A supplied in-line fuse is also included with the CLS-series cargo lift scale. The fuse comes enclosed in an in-line fuseholder (shown in Figure 3-5) and is attached where the stripped termination of the wires is located. Replacement of the in-line fuse is described in the CLS-Series Service manual if needed.

Figure 3-5. Inline Fuse

Attach the three stripped wires to the forklift battery using the following wire code

Note ***Supplied termination hardware includes (3) 1/4" eyelets for 1/4" bolts.***

Wire Color	Signal
Red	Positive on Battery
Black	Negative on Battery
Blue	Chassis Ground

Table 3-1. Power Hookups to Forklift Battery

3.4 Routing the Power/Serial Communications Cable

Special care should be taken when routing the power/serial communications cable (**if the standard coil wired version is used**). To ensure that the signal cable is installed properly and away from situations that could cause it harm use the following steps.

1. Mount the indicator to the forklift per instructions in Section 3.1.
2. Lay the coiled up signal cable along the route between the indicator and the forklift scale.

Figure 3-6. Power/Serial Communications Cable

Note ***The preferred route is through the center of the mast. If it has a three stage mast, route alongside the mast as shown in Figure 3-7.***

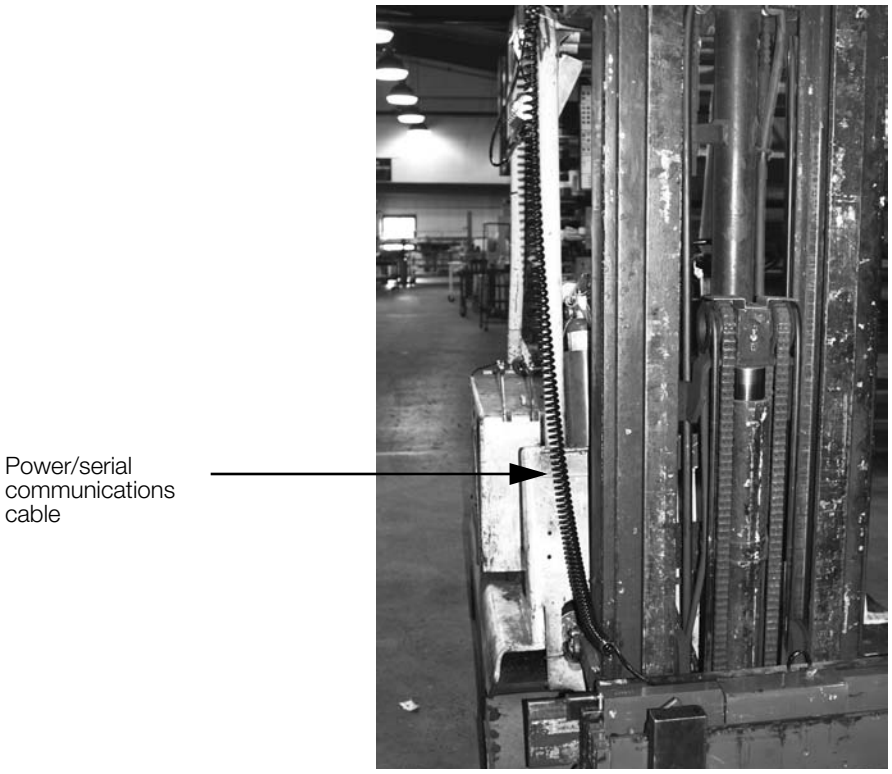


Figure 3-7. Signal Cable Located Between the Scale and the Indicator

3. Secure with cable ties at the bottom of the scale and at the top of the mast.
4. Slowly and carefully extend the mast to all positions to confirm that the cable isn't pulled too tight or that there are no pinch points along the way.
5. Check for proper signal cable clearance as the side shifter (if used), is moved back and forth.
6. **DO NOT plug the power connector into the bottom of the indicator until power hookup is completed.**

3.5 Supplying Power to the Two-Channel iQube Using a Lithium-Ion Battery

If using a wireless version of the CLS-420, the CLS scale uses a supplied lithium-ion battery to supply power. The wireless version of the CLS-420 does not come with a coiled cable. The lithium-ion battery is located on the top of the cover plate in a painted enclosure.

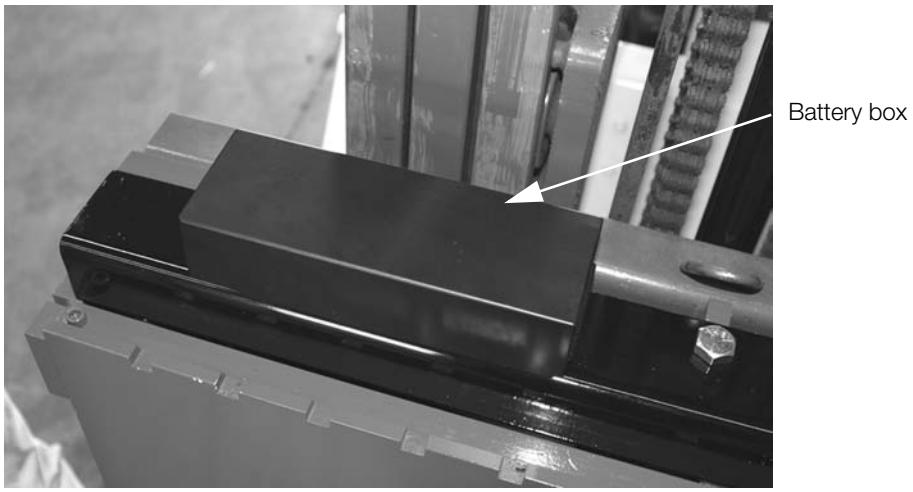


Figure 3-8. Lithium-ion Battery Location

3.5.1 Lithium-Ion Battery Specifications

Nominal Capacity		6600 mAh
Nominal Voltage		11.1 V
Charging Method		Constant Current
		Constant Voltage
Charging Voltage		12.6 V
Charging Current		4.0 A
Charging Time		100% @2.5 hours
Ambient Temperature	Charge	0° - +40°C
	Discharge	-20° - +60°C
	Storage	-20° - +50°C
Weight (Maximum)		430 g
Dimensions (Maximum)	Depth	22.80 mm
	Length	214.0 mm
Volumetric Energy Density		466 Wh/l
Gravimetric Energy Density		167 Wh/kg
Maximum Hours of Charge		8

Table 3-2. Battery Specifications

3.5.2 General Precautions

There are some general precautions that should be taken when handling lithium-ion batteries.

Handling

- Do not short circuit
- Do not immerse in water
- Do not disassemble or deform battery
- Keep away from excessive heat (+100°C) or dispose of battery in fire
- Avoid excessive physical shock or direct vibration
- Keep out of reach of children
- Never use a battery that appears to have suffered abuse
- Do not crush or attempt to disassemble the battery

Charge and Discharge

- Battery must be charged in an appropriate charger only
- Never use a modified or damaged charger
- Specified product use only

Storage

- Store in a cool, dry and well ventilated area

Disposal

- Regulations vary for different countries. Dispose of in accordance with local regulations

3.5.3 Charging the Lithium-Ion Battery

The lithium-ion battery comes with a two-bay, level-3 stand alone smart battery charger, a DC power jack, and a AC power cord as shown in Figure 3-9.

Figure 3-9. Two-Bay Battery Charger and Parts for the Lithium-Ion Battery

The average charge time for the battery is three hours each.

Use the following steps to charge the battery prior to use:

1. Insert the plug end of the power cable into the DC power jack on the battery charger and the AC plug into an outlet.
2. Insert battery into the bay.
3. There is one LED indicator in front of each bay which will illuminate to indicate the status of the battery as follows:

Signal	Description
Off	No Battery
Green Flashing	Fast Charging
Green Solid	Fully Charged
Yellow Flashing	Recalibrating
Yellow/Green Alternating	Recalibrating
Yellow Solid	Standby
Red Flashing	Error

Table 3-3. Battery Charging LED Signals

3.5.4 Calibrating the Lithium-Ion Battery

In order to keep the battery fuel gauge as accurate as possible, it is necessary to occasionally run the pack through a recalibration cycle. To do this, place the battery in the left bay of the charger and press the button on the front label (see Figure 3-9). This will initiate the recalibration sequence in the **left bay** only. The process can take up to nine hours to complete and a recommended recalibration should be done once quarterly to keep the battery accurate.

3.5.5 Battery Removal

The lithium-ion battery itself is housed inside of the battery box and is encased in a foam core protecting it from vibration.

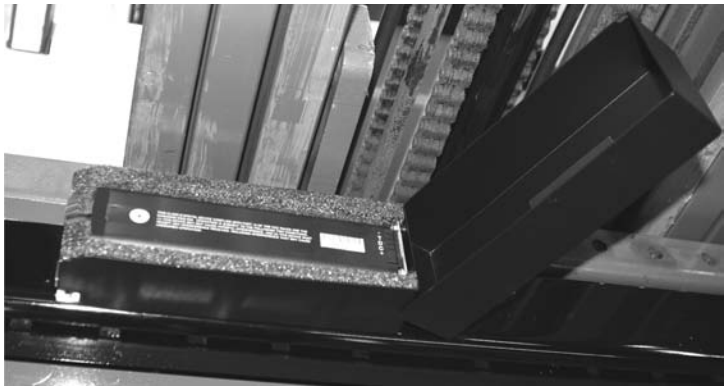


Figure 3-10. Lithium-ion Battery Box Opened

Figure 3-11 shows how to pull the lithium-ion battery out of the battery box.

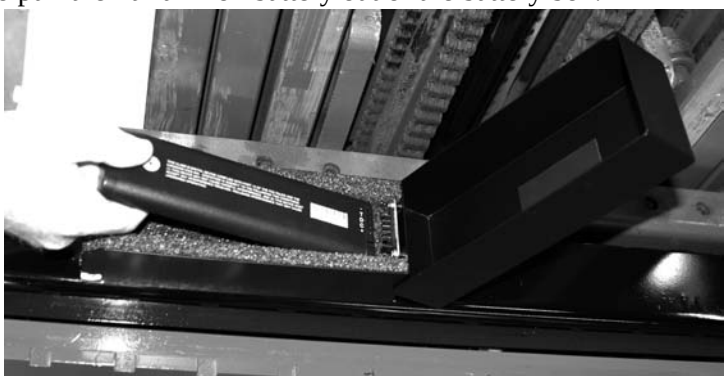


Figure 3-11. Pulling the Lithium-ion Battery Out

If the battery is not put back into the battery box correctly or the battery is not functioning correctly, the following error message is displayed on the 420 indicator.

Figure 3-12. Comm Error Message

The forklift operator can find out how many hours are left in the battery by pressing the setpoint key on the 420 indicator. The following screen is displayed pointing out the number of hours remaining.

Figure 3-13. Battery Hours Remaining

3.5.6 Battery Disposal

When using Lithium-ion batteries, be sure to observe the following precautions for disposal as stated in the material safety data sheet regarding lithium-ion batteries.

national power™
CORPORATION

MSDS
LITHIUM-ION BATTERIES (Li-ion)

The batteries referenced herein are exempt articles and are not subject to the OSHA Hazard Communication Standard requirement. This sheet is provided as a service to our customers.

MSDS

Material Safety Data Sheets (MSDS) are a sub-requirement of the Occupational Safety and Health Administration (OSHA) Hazard Communication Standard, 29 CFR Subpart 1910.1200. This Hazard Communication Standard does not apply to various subcategories including anything defined by OSHA as an "article". OSHA has defined "article" as a manufactured item other than a fluid or particle; (i) which is formed to a specific shape or design during manufacture; (ii) which has end use function(s) dependent in whole or in part upon its shape or design during end use; and (iii) which under normal conditions of use does not release more than very small quantities, e.g. minute or trace amounts of a hazardous chemical, and does not pose a physical hazard or health risk to employees.

Because all of our batteries are defined as "articles", they are exempt from the requirements of the Hazard Communication Standard; hence a MSDS is not required.

The following components are found in a Lithium Ion battery:

Component	Material	Formula
Positive Electrode	Lithium Cobalt Oxide	$LiCoO_2$
Negative Electrode	Graphite	C
Electrolyte	Ethylene Carbonate – Solvent	$C_3H_4O_3$
	Diethyl Carbonate – Solvent	$C_5H_{10}O_3$
	Lithium Hexaflurophasphate – Salt	$LiPF_6$

The overall reaction is: $Li_xC + Li_{1-x}CoO_2 \leftrightarrow C + LiCoO_2$

Disposal

All Lithium Ion batteries are classified by the federal government as non-hazardous waste and are safe for disposal in the normal municipal waste stream. These batteries, however, do contain recyclable materials and are accepted for recycling by the Rechargeable Battery Recycling Corporation's (RBRC) Battery Recycling Program. Please call 1-800-8-BATTERY for information on recycling your used Lithium Ion battery or go to the RBRC website at www.rbrc.org for additional information.

Transportation

All lithium (primary and rechargeable) batteries are not subject to the requirements of the U.S. Department of Transportation (DOT) Subchapter C, Hazardous Material Regulations because each of our batteries meets the exceptions under 173.185 (b). These regulations will remain in effect until we are advised of new regulations.

All lithium batteries are exempt from the DOT Hazardous Materials Subchapter as long as they are separated to prevent short circuits and packed in strong packing for conditions normally encountered in transportation.

Notice: The information and recommendations set forth are made in good faith and are believed to be accurate at the date of preparation. We make no warranty expressed or implied.

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3.6 Two-Channel iQube Junction Box

The two-channel iQube sits in an area between the front and back plate of the scale itself providing protection for the junction box. The two-channel iQube comes from the factory pre-wired and no additional work needs to be done to it other than sealing the iQube for Legal-For-Trade applications. Should the user need to replace load cells, then additional information on wiring is located in the *CLS-Series Service manual*, PN 96314.

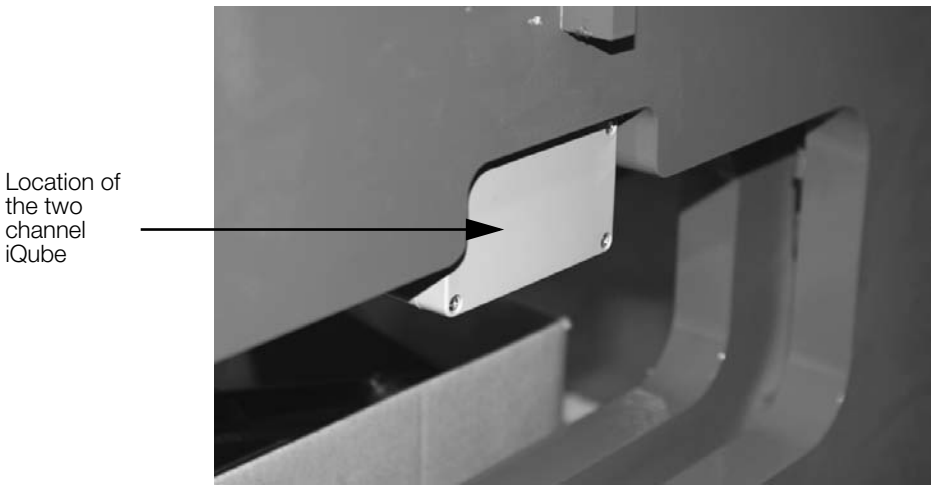


Figure 3-14. Location of Two-Channel iQube on CLS-Series Scale

4.0 ABF Version

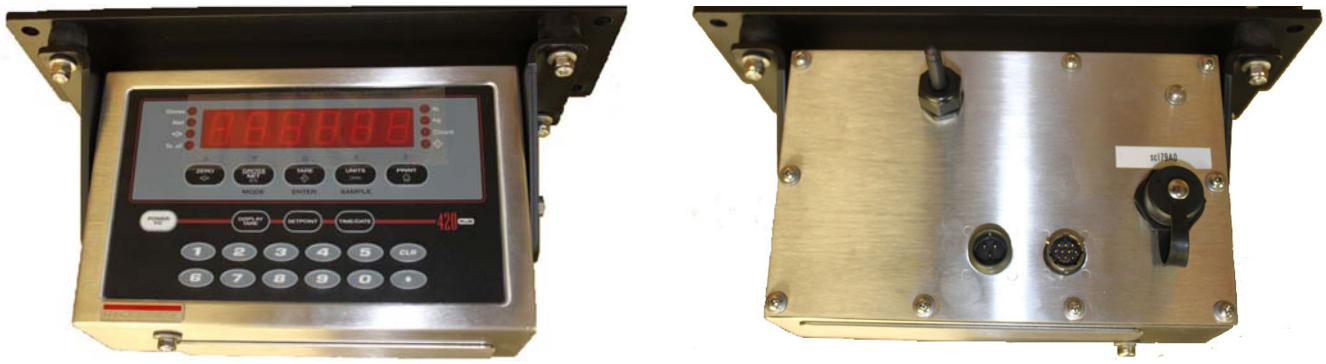


Figure 4-1. ABF Version Indicator

4.1 ABF Version Differences

4.1.1 Mount Kit Assembly

(PN 131630)

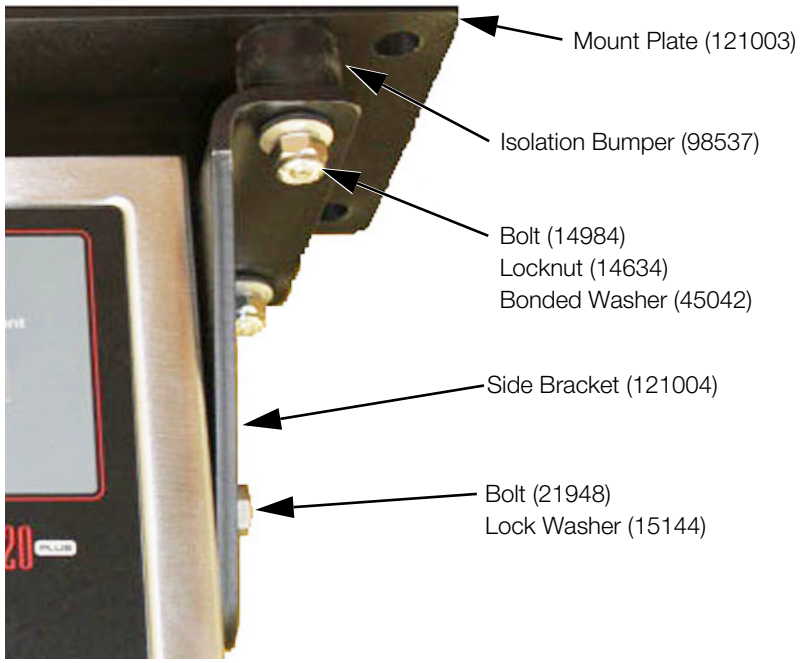


Figure 4-2. Mounting the Indicator

- Two mount plates (121003) used to clamp the indicator to the forklift frame.
- Two side brackets (121004) are mounted to one of the plates with:

Four (4) isolation bumpers (98537)

Four (4) 1/4-20NC x 1-3/4 bolts (14984)

Four (4) 1/4” lock nuts (14634)

Eight (8) bonded washers (45042)

- Side brackets are attached to each side of the indicator with 1/4” x 5/8” long bolts (21848) and lock washers (15144).
- Standard plastic washers (15144) are used between the brackets and the indicator.

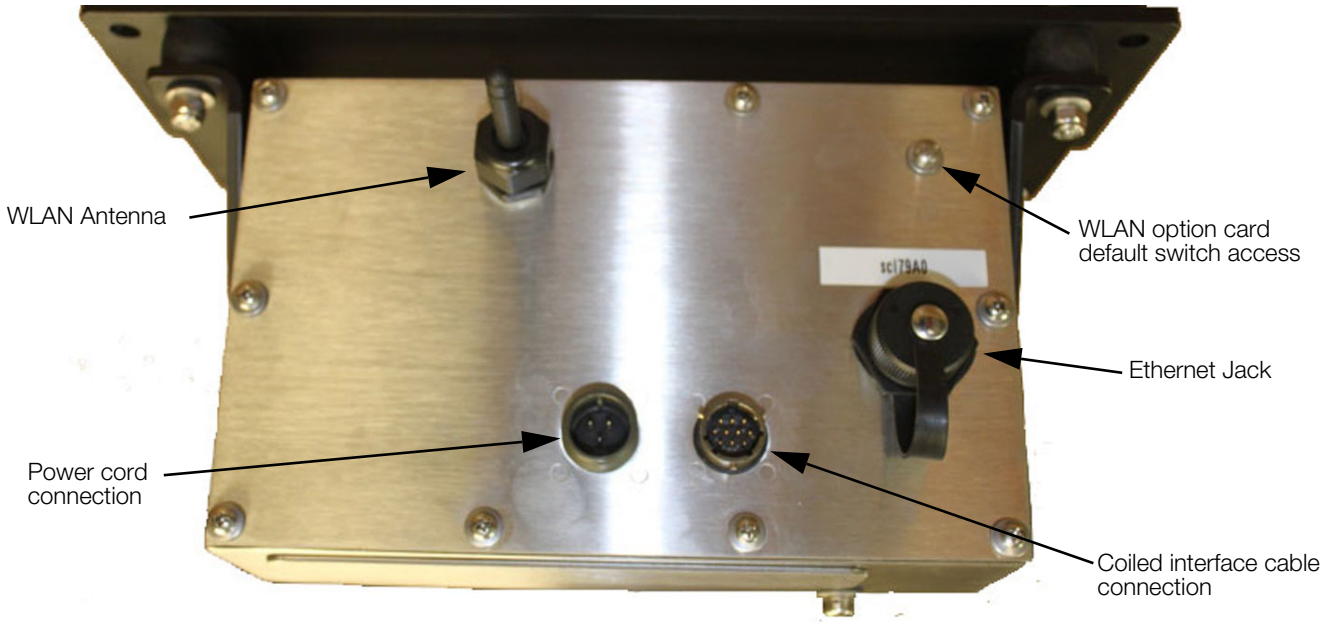


Figure 4-3. Indicator Back View

4.1.2 Rear Cover - External Connections:

- All connections come out the back.
- There is a single cord grip with a WLAN antenna mounted in it. The grip can be loosened and the antenna position as needed. If needed, the antenna can be pulled out far enough to expose its joint, at which time the antenna can be angled as needed

Note ***If the joint is exposed, the enclosure will not be as environmentally protected.***

- An additional connector is also included to allow a wired Ethernet connection to the internal WLAN board.

Note ***If an Ethernet connection is made before the unit is powered on, the WLAN board will revert to a wired mode, allowing configuration via DeviceInstaller over an Ethernet network before placing it in service on a wireless network. See Section 4.2.***

- A small slotted screw located in the upper right corner above the Ethernet jack. Behind this screw is a switch used to reset the WLAN module to factory defaults. See Section 4.1.4.

Note ***For sealing purposes, this screw DOES NOT need to be sealed.***

Power Connection	
Pin	
A	Battery Positive 10-36V
B	Battery Negative
C	Chassis Ground

CoiledCableConnection	
Pin	
A	+V (7.5v)
B	GND
D	RXD
E	TXD
F	GND

Table 4-1. Cable Pinouts

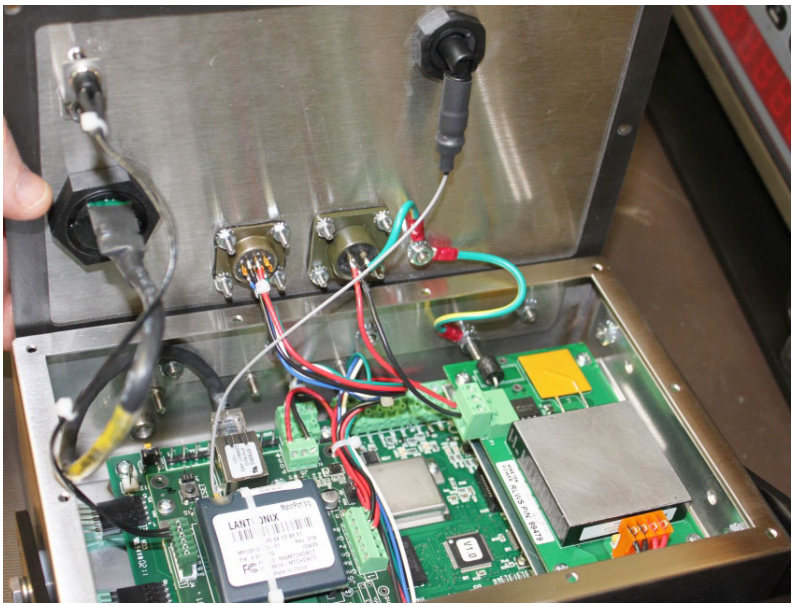


Figure 4-4. Inside the Indicator

4.1.3 Installed WLAN Interface

For use with ABF CLS 420i and Mega 8 indicators only.

- The board is mounted to the 420 CPU board in place of the Analog Output module.
- The WLAN Port 1 serial connection connects to the Printer port on the 420 CPU board.
- The power connections to the to the WLAN board go directly to the Power Supply.
- Power for the WLAN option board is controlled by a connection between the +5V digital output connection on the CPU board tot he REM connection on the WLAN option board.

Note ***The WLAN option board power jumper must be in the REM position.***

- The Wired Ethernet jack on the WLAN board is connected to a jack on the back panel for use with initial configuration.

Run the Lantronix DeviceInstaller program on the company network.

When a new indicator arrives, it is connected to the Ethernet network and turned on.

The WLAN card recognizes the Ethernet connection and changes automatically to Wired Ethernet mode.

The board receives a DHCP-assigned IP address, with a DHCP name that is “sclxxxx” where the “xxxx” is the last four digits of the MAC address of the Matchport module.

When the indicator is made, a small sticker is applied to the back with this DHCP name on it.

Note ***The DHCP name can be changed during configuration if desired.***

- Use DeviceInstaller to configure the module’s WLAN settings (SSID and security) so it will attach to the wireless network. After configuration, remove the Ethernet connection, then cycle power on the indicator. The WLAN module should then attach to a wireless network and be available for communications.

4.1.4 Default Indicator

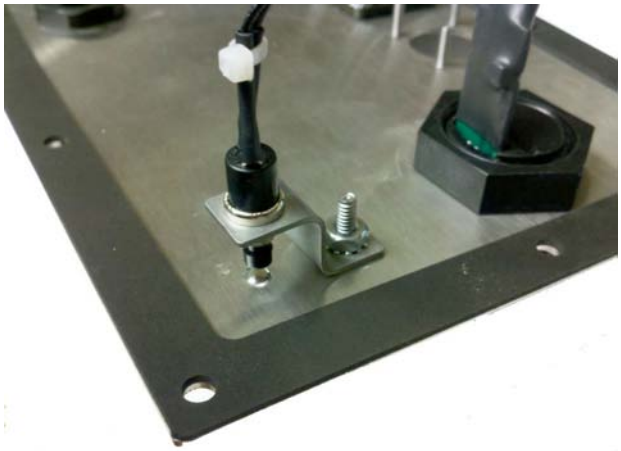


Figure 4-5. Reset Switch

- If the module setting corrupts or if the indicator is moved to a new facility, and there is a problem getting it to connect to either the wired, or wireless network, a factory default switch is provided to wipe ALL configuration in the Matchport to a known state.

This function will reset ALL settings, including the Wireless and IP settings and will set the module up for Wired Connections ONLY.

Setting the defaults with the switch

1. Remove the small screw from the upper right corner of the back panel.
2. With the indicator off, press and hold the switch.
3. Turn the indicator on and wait 10 seconds,
4. Turn the indicator off and release the switch.

The module is now set to factory defaults and in Wired Mode only.

Reconfigure by connecting the indicator to a Wired Ethernet network using the DeviceInstaller or browser. When complete, make sure to set the network mode back to "Wireless Only".

4.1.5 Supplying power to the carriage J-box.

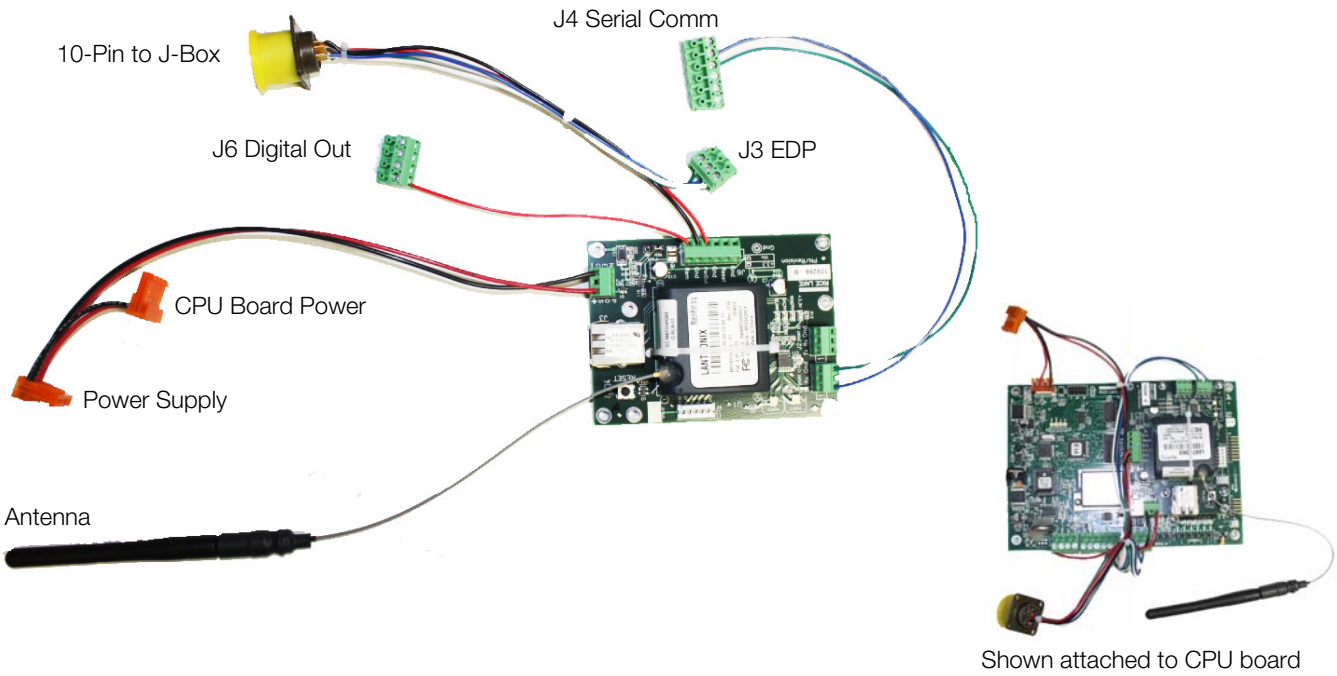


Figure 4-6. Ind Opt, WLAN 420-CLS

- Ind Opt, WLAN 420-CLS (121045) Can be ordered as a complete assembly or individual parts as listed in Table 4-2.

Part #	Description
109266	Board Assy, Universal
112226	Module, Wifi Matchport, Custom Firmware
112228	Cable RF UFL to RSMA 6in
115509	Glue,Jet-Melt
118877	Cable ASSY,Power Supply
120998	Cable Assy, Serial Input
15422	Wire,22AWG Red Stranded
15425	Wire,22AWG Green Stranded
15426	Wire,22AWG Blue Stranded
15429	Wire,22AWG White Stranded
15631	Cable Tie,3in Nylon
15642	Tubing,Heat Shrink 3/8
21896	Label,Anti-Static Warning
58579	Strap,Tie 8 in Length
70599	CONN,6 Pos Screw Terminal
71126	CONN,4 Pos Screw Terminal
98357	Antenna, 2.4GHz 802.11B/G

Table 4-2. Ind Opt, WLAN 420-CLS Parts List

4.2 Special Matchport Firmware

The Matchport module (112226) used by ABF version have a modifications in the firmware.

- Even with the card set to “Wireless Only”, if during boot-up it detects an Ethernet connection, it will revert to Ethernet for that session only.
- When the cable is removed and power cycled, it will go back to a Wireless mode. This was done for ease of configuration using DeviceInstaller (as opposed to the RS232 method).

Power MUST be cycled for it to switch back to wireless mode - just removing the cable DOES NOT switch it back to a wireless connection.

- The module creates a unique DHCP name from its MAC address (see Section 4.1.3).
- The baud rate of both serial channels is set to 19200 to match the settings of their Mega 8 indicators.
- The input and output buffers are always flushed.
- Two of the general purpose inputs are set to allow the module to be set to factory defaults

The first GPIO to set the module to Default and Wireless Mode Only.

- The TCP Port Numbers for the two serial channels.

This firmware uses 8023 and 8024. Take note of that if troubleshooting.

4.2.1 420 Core Firmware

New EDP command and different defaults.

- Default baud rate for the Printer Port is now 19200. DO NOT CHANGE THIS!
- Zero Track Band default is 1D
- Zero range default is 100%.
- New EDP command, “P” (no carriage return or line feed). If talking to the indicator, simply send “P” and it will respond with a single frame of stream data, no matter the status. “SENT” will appear on the 420 screen for a couple second after the 420 is successful in sending the response to the “P” command.

This DOES NOT mean the handheld device received the data, just that the 420 sent it. The 420 itself does not know if there is a good network connection or not, but if it got the “P” from the network, then the downstream data is working. If the indicator says “SENT”, but the data is not getting back on the network, then check the TX line from the 420 CPU to the RX of the WLAN card, and the RX LED on the WLAN card to make sure it blinks.

- In weigh mode, **ALL the keys on the keypad are DISABLED** except the “ZERO” key. Operators can only use the zero key. The zero key is like a Tare - zeroing off empty pallets and such before taking weighments.
- Messages in error conditions:

Angle is over 3°, the display actually says “Angle”.

Overload or underload, the display shows “Over” and “Under”.

Default indicator if any settings become corrupt to return to default settings. See Section 4.1.4.

5.0 Configuration

While the functionality remains the same for a standard 420 digital weight indicator, there are certain menu choices that need to be changed in the Configuration Section of this manual specific to the proper functioning of the CLS-Series Cargo Lift Scale which include Calibration, Serial, Program, and Print Format.

To configure the 420 indicator, the indicator must be placed in setup mode. The setup switch is accessed by removing the large fillister head screw on the enclosure bottom. Switch position is changed by inserting a screwdriver or similar tool into the access hold and pressing the setup switch.

When the indicator is placed in setup mode, the word config is shown on the display. the CONFIG menu is the first of ten main menus used to configure the indicator. Detailed descriptions of these menus are given in Section 5.2 on page 24. When configuration is complete, return to the CONFIG menu and press the **ZERO** key to exit setup mode, then replace the setup switch access screw.

5.1 Configuration Methods

The 420 indicator can be configured by using the front panel keys to navigate through a series of configuration menus or by sending commands or configuration data to the EDP port. Configuration using the menus is described in Section 4.2 on page 24.

5.1.1 EDP Command Configuration

The serial command set can be used to configure the 420 indicator using either a personal computer, terminal, or remote keyboard. Serial command configuration sends commands to the indicator serial port; serial commands can be sent using any external device capable of sending ASCII characters over a serial connection.

EDP commands duplicate the functions available using the indicator front panel and provide some functions not otherwise available. Serial commands can be used to simulate pressing front panel keys, to configure the indicator, or to dump lists of parameter settings.

5.1.2 Front Panel Configuration

The 420 indicator can be configured using a series of menus accessed through the indicator front panel when the indicator is in setup mode. Table 5-1 summarizes the functions of each of the main menus.

Menu		Menu Function
CONFIG	Configuration	Configure grads, zero tracking, zero range, motion band, overload, tare function, sample rate and digital filtering parameters
FORMAT	Format	Set format of primary and secondary units, display rate
CALIBR	Calibration	Calibrate indicator. See Section 5 for calibration procedures
SERIAL	Serial	Configuration and printer serial ports. EDP is dedicated to the two-channel iQube.
PROGRM	Program	Set power-up mode, regulatory mode, and consecutive number values
PFORMT	Print Format	Set print format used for gross and net tickets.
SETPNT	Setpoint	Configure setpoints and digital outputs
DIG IN	Digital Input	Assign digital input functions
ALGOUT	Digital Output	Configure analog output module. Used only if analog output option is installed
VERS	Version	Display installed software version number

Table 5-1. 420 Menu Summary

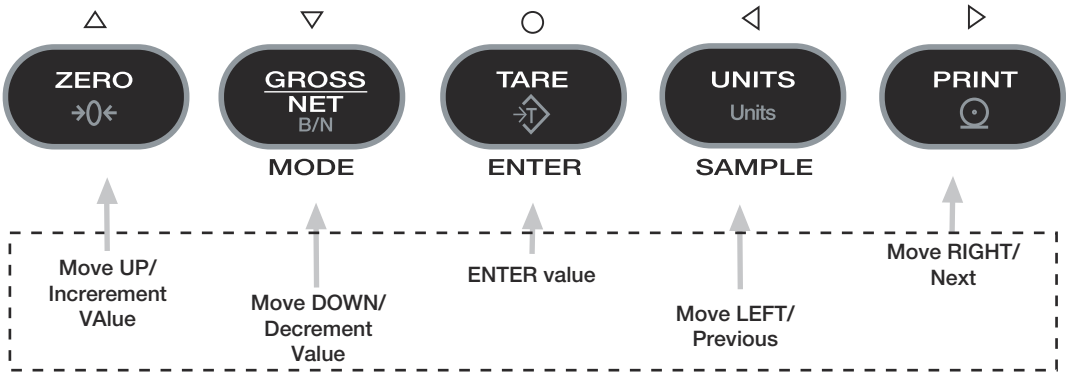


Figure 5-1. Front Panel Key Functions in Setup Mode

Four front panel keys are used as directional keys to navigate through the menu in setup mode (see Figure 5-2) The **UNITS** and **PRINT** keys scroll left and right horizontally on the same menu level; **ZERO** and **GROSS/NET** move up and down (vertically) to different menu levels. The **TARE** key serves as an **Enter** key for selecting parameter values within the menus. A label above each of these keys identifies the direction provided by the key when navigating through the setup menus.

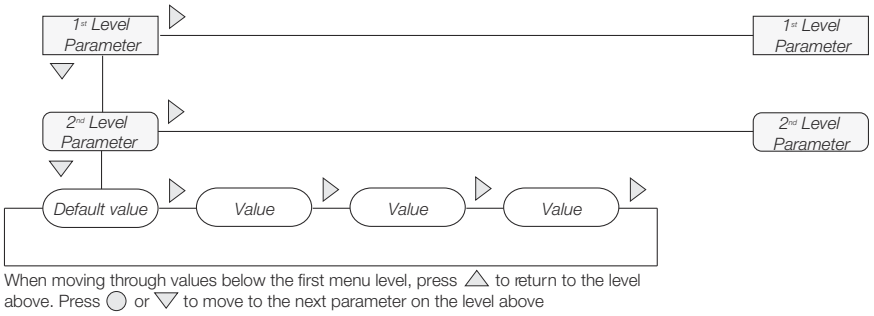

1st Level Parameter
1st Level Parameter
2nd Level Parameter
2nd Level Parameter
Default value
Value
Value
Value
When moving through values below the first menu level, press △ to return to the level above. Press ○ or ▽ to move to the next parameter on the level above

Figure 5-2. Setup Mode Menu Navigation

To select a parameter, press the left or the right arrow to scroll left or right until the desired menu group appears on the display, then press the down arrow to move down to the submenu or parameter you want. When moving through the menu parameters, the default or previously selected value appears first on the display.

To change a parameter value, scroll left or right to view the values for that parameter. When the desired value appears on the display, press o to select the value and move back up one level. To edit numerical values, use the navigation keys to select the digit and to increment or decrement the value or use the numeric keypad. See Figure 5-3.

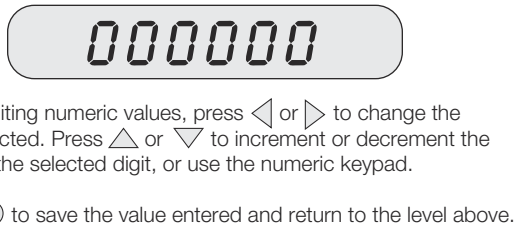

000000
When editing numeric values, press ◁ or ▷ to change the digit selected. Press △ or ▽ to increment or decrement the value of the selected digit, or use the numeric keypad.
Press ○ to save the value entered and return to the level above.

Figure 5-3. Editing Procedure for Numeric Values

5.2 Menu Structures and Parameter Descriptions

The following sections provide graphic representations of the 420 menu structures. In the actual menu structure, the setting you choose under each parameter are arranged horizontally. To save page space, menu choices are shown in vertical columns. The factory default setting appears at the top of each column in bold type.

Most menu diagrams are accompanied by a table that describes all parameters and parameter values associated with that menu. Default parameter values are shown in bold type.

5.2.1 Configuration Menu

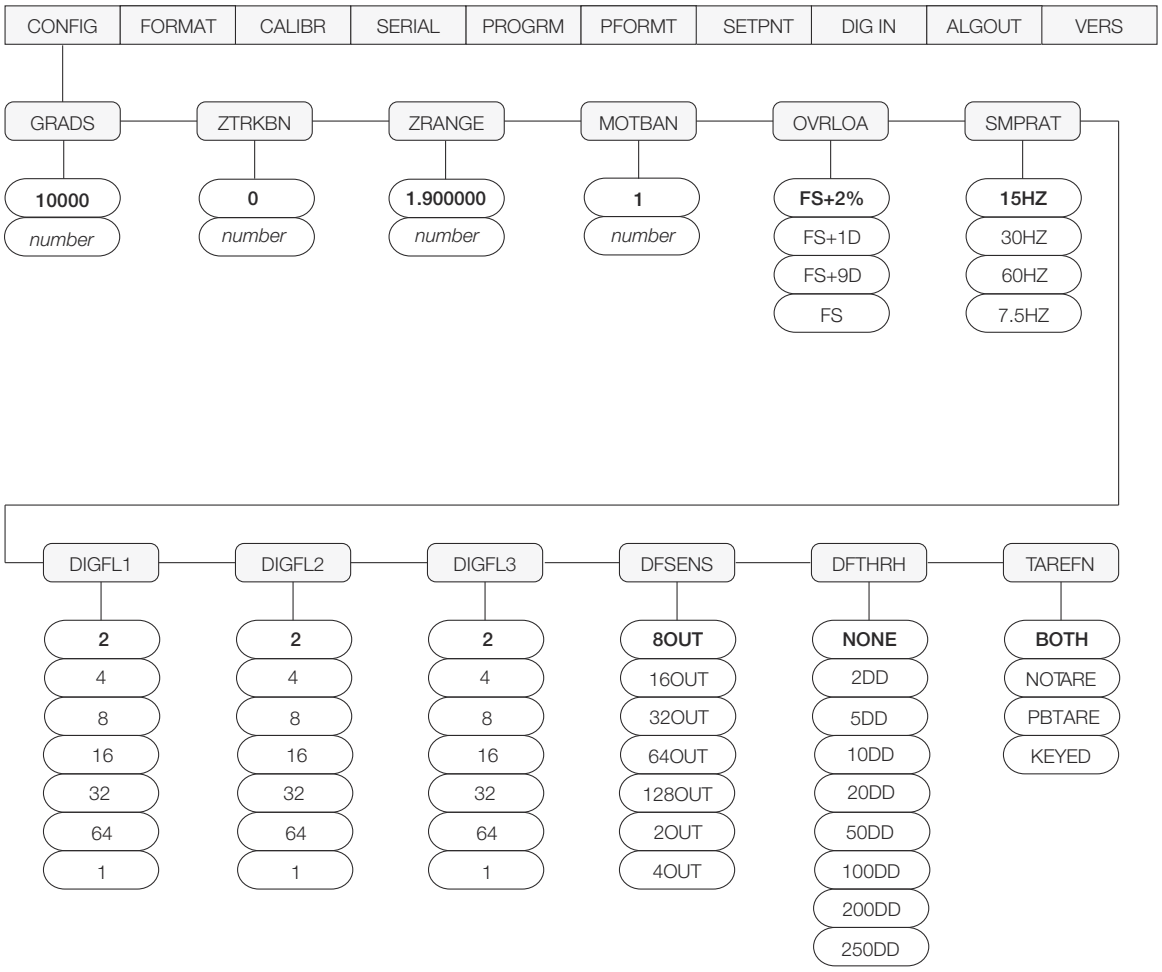


Figure 5-4. Configuration Menu

CONFIG Menu		
Parameter	**Choices**	**Description**
Level 2 submenus		
GRADS	**1000** number	Graduations. Specifies the number of full scale graduations. The value entered must be in the range 1-100 000 and should be consistent with legal requirements and environmental limits on system resolution. To calculate GRADS, use the formula, GRADS=*Capacity / Display Divisions* Display divisions for primary and secondary units are specified on the FORMAT menu.
ZTRKBND	0 *number*	Automatically zeroes the scale when within the range specified, as long as the input is within the ZRANGE and scale is at standstill. Specify the zero tracking band in ± display divisions. Maximum legal value varies depending on local regulations. *NOTE: For scales using linear calibration, do not set the zero tracking band to a value greater than that specified for the first linearization point.*

Table 5-2. Configuration Menu Parameters

CONFIG Menu		
ZRANGE	1.900000 *number*	Selects the range within which the scale can be zeroed. The 1.900000 default value is ± 1.9% around the calibrated zero point, for a total range of 3.8%. Indicator must be at standstill to zero the scale. Use the default value for legal-for-trade applications.
MOTBAND	1 *number*	Sets the level, in display divisions, at which scale motion is detected. If motion is not detected for 1 second or more, the standstill symbol lights. Some operations, including print, tare, and zero, require the scale to be at standstill. Maximum legal value varies depending on local regulations. If this parameter is set to 0, the standstill annunciator will be set continuously on, and operations including zero, print, and tare will be performed regardless of scale motion. If 0 is selected, ZTRKBND must also be set to 0.
OVRLOA	**FS+2%** FS+1D FS+9D FS	Overload. Determines the point at which the display blanks and an out-of-range error message is displayed. Maximum legal value varies depending on local regulations.
SMPRAT	**15HZ** 30HZ 60HZ 7.5HZ	Sample rate. Select measurement rate, in samples per second, of the analog-to-digital converter. Lower sample rate values provide greater signal noise immunity.
DIGFL 1 DIGFL 2 DIGFL 3	**2** 4 8 16 32 64 1	Digital filtering. Selects the digital filtering rate used to reduce the effects of mechanical vibration from the immediate area of the scale. Choices indicate the number of A/D conversions that are averaged to obtain the displayed reading. A higher number gives a more accurate display by minimizing the effect of a few noisy readings, but slows down the setting rate of the indicator. See Section 8.7 on page 47 for more information on digital filtering.
DFSENS	**8OUT** 16OUT 32OUT 64OUT 128OUT 2OUT 4OUT	Digital filter cutout sensitivity. Specifies the number of consecutive readings that must fall outside the filter threshold (DFTHRH parameter) before digital filtering is suspended. If NONE is selected, the filter is always enabled.
DFTHRH	**NONE** 2DD 5DD 10DD 20DD 50DD 100DD 200DD 250DD	Digital filter cutout threshold. Specifies the filter threshold, in display divisions. When a specified number of consecutive scale readings (DFSENS parameter) fall outside of this threshold, digital filtering is suspended. if NONE is selected, the filter is always enabled.
TAREFN	**BOTH** NOTARE PBTARE KEYED	Tare function. Enables or disables push-button and keyed tares. Possible values are: BOTH: Both push-button and keyed tares are enabled NOTARE: No tare allowed (gross mode only) PBTARE: Push-button tares enabled KEYED: Keyed tare enabled

Table 5-2. Configuration Menu Parameters

5.2.2 Format Menu

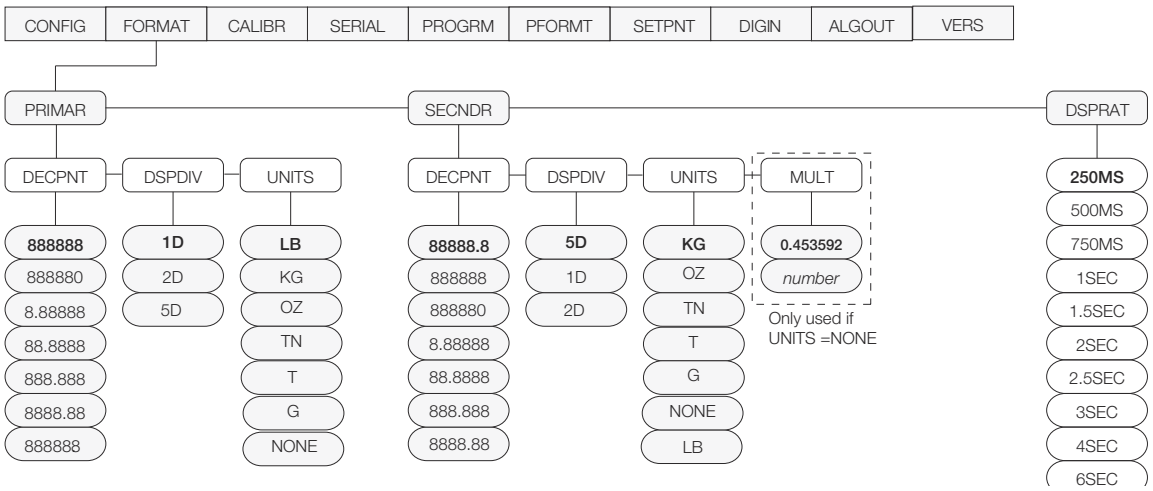


Figure 5-5. Format Menu

Format Menu		
Parameter	**Choices**	**Description**
Level 2 submenus		
PRIMAR	DECPNT DSPDIV UNITS	Specifies the decimal position, display divisions, and units used for the primary unit. See Level 3 submenu parameter descriptions.
SECNDR	DECPNT DSPDIV UNITS MULT	Specifies the decimal position, display division, units , and conversion multiplier used for the secondary units. See Level 3 submenu parameter descriptions.
DSPRAT	**250MS** 500MS 750MS 1SEC 1.5SEC 2SEC 2.5SEC 3SEC 4SEC 6SEC 8SEC	Display rate. Set the update rate for displayed values. Values are in milliseconds (MS) or seconds (SEC).
Level 3 submenus		
Primary Units (PRIMAR Parameter)		
DECPNT	**888888** 888880 8.8888 88.8888 888.888 8888.88 8888.8	Decimal point location. Determines the location of the decimal point or dummy zeros in the secondary unit display.
DISPDIV	**1D** 2D 5D	Display divisions. Selects the value of minimum division size of the displayed weight.

Table 5-3. Format Menu

Format Menu		
UNITS	**LB** KG OZ TN T G NONE	Specifies primary units for displayed and printed weight. Values are: LB=pound; KG=kilogram, OZ=ounce, TN=short ton; T=metric ton, G=gram Note: Indicators sold outside North America are configured with KG for both primary and secondary units
Secondary Units (SECNDR Parameter)		
DECPNT	**88888.8** 888888 888880 8.88888 88.8888 888.888 8888.88	Decimal point location. Determines the location of the decimal point or dummy zeros in the secondary unit display.
DISPDIV	**5D** 1D 2D	Display divisions. Selects the value of minimum division size of the displayed weight.
UNITS	**KG** OZ TN T G NONE LB	Specifies secondary units for displayed and printed weight. Values are: KG=kilogram, OZ=ounce; TN=short ton; T=metric ton, G=gram; LB=pound
MULT	**0.453592** *Enter other choices via keyboard*	Multiplier. Specifies the conversion factor by which the primary units are multiplied to obtain the secondary units. The default is 0.453592, which is the conversion factor for changing pounds to kilograms. Note: Multipliers are pre-configured within the indicator. Manual entry is only necessary when NONE is selected under UNITS. To toggle between primary and secondary units, press the UNITS key.

Table 5-3. Format Menu

5.2.3 Calibration Menu

Figure 5-6 illustrates the calibration procedures for the CLS-420 using two load cells. It does not represent the basic Calibration menu for the 420 indicator**.**

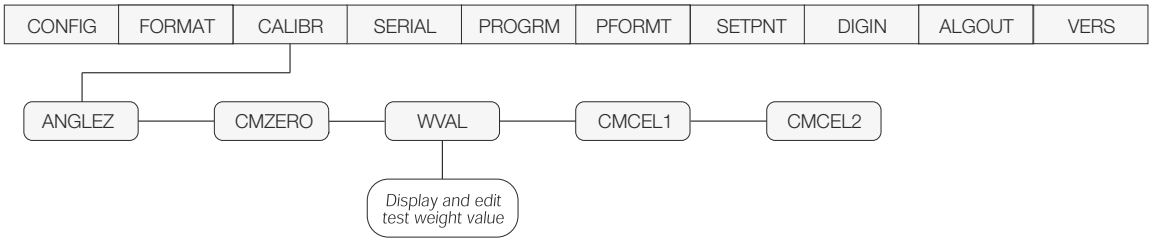


Figure 5-6. CLS-420 Calibration Menu Using Two Load Cells

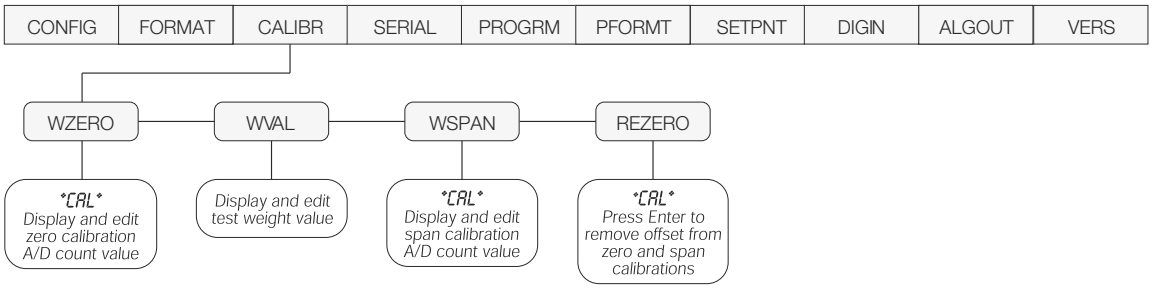


Figure 5-7. Basic 420 Calibration Menu

CALIBR Menu		
Parameter	**Choices**	**Description**
Level 2, submenu		
ANGLEZ	—	Calibrate the inclinometer pitch and roll angles on the two-channel iQube when the pitch and roll angles are zero. This operation tells the two-channel iQube to use the current readings from the MEMS inclinometer and store these angle measurements as offsets that are applied to the current measurement angle that are used in calculating the correction factor that is applied to the weight.
CMZERO		Setup the two-channel iQube for calibration match (Cal-Match) This tells the two-channel iQube that the calibration mode is set for Cal-Match, initialize variables for the calibration then do a Zero Calibration (no load).
WVAL	—	Display and edit the test weight value
CMCEL1 through CMCEL2	—	This parameter is used to calibrate a particular load cell with a load with CELL1 being the left side fork as viewed from the drivers position CELL2 being on the right hand side as viewed from the drivers position. This tells the two-channel iQube to calibrate a particular load cell. These steps must be performed in order, CMCEL1 (left fork) first, followed by CMCEL2 (right fork).

Table 5-4. SCALES Menu, CALIBR Submenu Parameters

5.2.4 SERIAL Menu

Figure 5-8 illustrates the serial menu and their associated settings for the functionality of the CLS-420 Cargo Lift Scale. ***It should be noted that the EDP port is dedicated to the two channel iQube communication and is automatically set when the SSCALE parameter is set to 2LCELL.*** Table 5-5 below, illustrates the different serial settings used for CLS functionality and a basic 420 indicator.

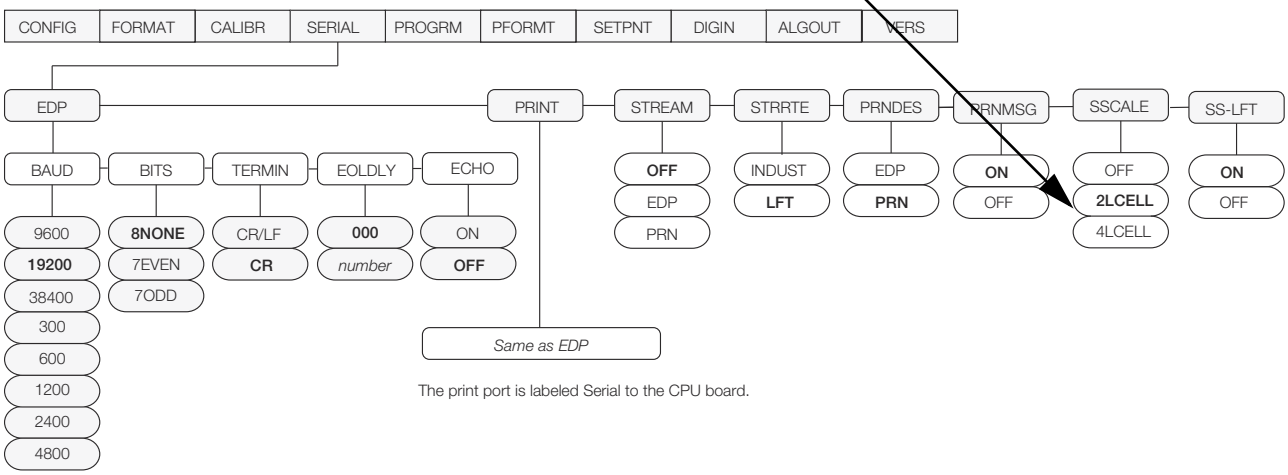


Figure 5-8. CLS-420 SERIAL Menu

The SSCALE parameter on the serial menu must be set to 2LCELL for use with the CLS-420 Cargo Lift Scale. If it is set to OFF, then the 420 indicator will function with a standard 420 calibration menu.

SSCALE Parameter Settings		
Parameter	**If set to OFF**	**If set to 2LCELL**
Baud	9600	19200
Bits	8 None	8 None
Termin	CR/LF	CR
EOLDLY	000	000
Echo	On	Off

Table 5-5. SSCALE Parameter Settings

SERIAL Menu		
Parameter	**Choices**	**Description**
Level 2 submenus		
EDP - dedicated to the two channel iQube	BAUD BITS TERMIN EOLDLY ECHO	Specifies settings for baud rate, data bits, termination characters, end-of-line delay and echo used by the EDP port.
PRINT	BAUD BITS TERMIN EOLDLY ECHO	Specifies settings for baud rate, data bits, termination characters, end-of-line delay, and echo used by the printer port.
STREAM	**OFF** EDP PRN	Selects the serial port used for continuous transmission. See Figure 8.3 42 for information about the 420 continuous data format.
STRRTE	**INDUST** **LFT**	Specifies stream rate. Stream rate can be set to industrial or legal for trade.
PRNDES	EDP **PRN**	Print destination. Selects the port for data transmission when the print key is pressed or the KPRINT EDP command is sent.
PRNMSG	**ON** OFF	Print message. Default will be ON. When the print key is pressed and data is sent out, the word PRINT is momentarily displayed on the remote display.
SSCALE	OFF **2LCELL** 4LCELL	By selecting this option, it enables the scale to be used by the CLS series cargo lift scale.
SS-LFT	**ON** OFF	This parameter turns off the LFT 3 degree tilt warning.
Level 3 Submenus		**EDP Port and Printer Port**
BAUD	9600- Printer **19200 - EDP** 28800 38400 57600 115200 300 600 1200 2400 4800	Baud rate. Selects the transmission speed for the port.
BITS	**8NONE** 7EVEN 7ODD	Selects number of data bits and parity of data transmitted or received by the port.
TERMIN	CR/LF - Printer **CR - EDP**	Termination character. Selects termination character for data sent from the port.
EOLDLY	**000000** *0–255*	End-of-line delay. Sets the delay period, in 0.1-second intervals, from when a formatted line is terminated to the beginning of the next formatted serial output. Value specified must be in the range 0-255, in tenths of a second (10 = 1 second).
ECHO	**OFF - EDP** ON - Printer	This command enables or disables echoing of the serial commands sent to the indicator.

Table 5-6. Serial Menu Parameters

5.2.5 Program Menu

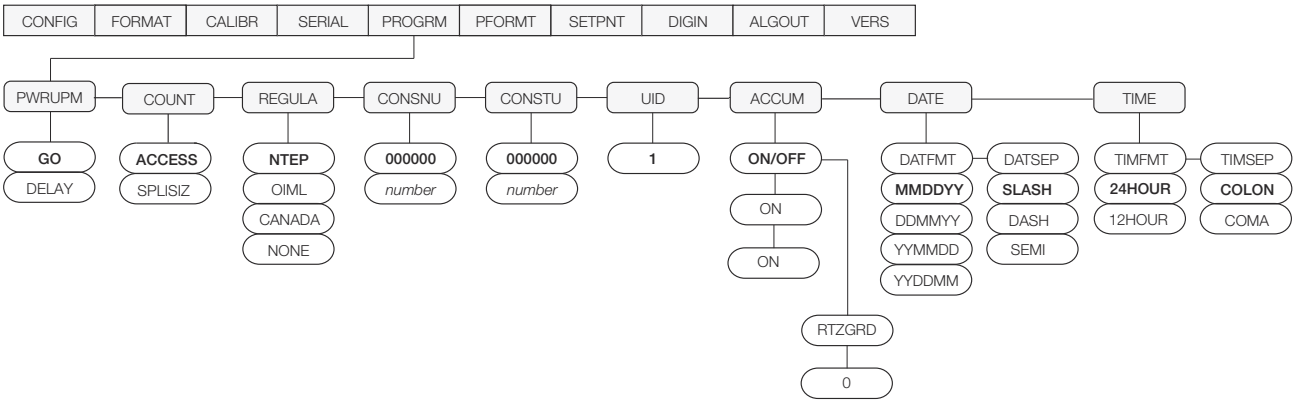


Figure 5-9. Program Menu

Program Menu		
Parameter	**Choices**	**Description**
Level 2 submenus		
PWRUPM	**GO** DELAY	Power up mode. In GO mode, the indicator goes into operation immediately after a brief power up display test. In DELAY mode, the indicator performs a power up display test, then enters a 30-second warm up period. If no motion is detected during the warm up period, the indicator becomes operational when the warm up period ends; if motion is detected, the delay timer is reset and the warm up period repeated.
COUNT	**ACCESS** SPLSIZ	Specifies whether the operator has access to piece count mode and the default sample size used for parts counting. See level three submenu for parameter descriptions.
REGULA	**NTEP** OIML CANADA NONE	Regulatory mode. Specifies the regulatory agency having jurisdiction over the scale site. OIML, NTEP, and CANADA modes allow a tare to be acquired at any weight greater than zero, NONE allows tares to be acquired at any weight value. OIML, NTEP, and CANADA modes allow a tare to be cleared only if the gross weight is at no load. NONE allows tares to be cleared at any weight value. NTEP and OIML modes allow a new tare to be acquired even if a tare is already present. In CANADA mode, the previous tare must be cleared before a new tare can be acquired. NONE, NTEP, and CANADA modes allow the scale to be zeroed in either gross or net mode as long as the current weight is within the specified ZRANGE. In OIML mode, the scale must be in gross mode before it can be zeroed; pressing the ZERO key in net mode clears the tare.
CONSNU	**000000** *number*	Consecutive numbering. Allows sequential numbering for print operations. The consecutive number value is incremented following each print operation. The initial value of this parameter is set to the start up value specified on the CONSTU parameter. Changing either CONSTU or CONSNU immediately resets the consecutive number used for printing.
CONSTU	**000000** *number*	Consecutive number start up value. Specifies the initial consecutive number (CONSNU) value used when the indicator is powered on.
UID	**1**	Specifies the unit identification number. Value specified can be any numeric value, up to six digits.

Table 5-7. FEATURE Menu Parameters

Program Menu		
Parameter	**Choices**	**Description**
ACCUM	ON/OFF RTZGRD	Turns the accumulator on and off. Stores the count, date & time of last accumulation. Returns to zero grads to re-arm the accumulator.
DATE	DATFMT DATSEP	Allows selection of date format and date separator. See level three parameter for descriptions.
TIME	TIMFMT TIMSEP	Allows selection of time format and separator. See level three parameter for descriptions.
Level 3 submenus		
ACCESS	**DISABLE** ENABLE	Operator access to piece count mode. Specify DISABLE if piece count mode will not be used. With access disabled, pressing the GROSS/NET Mode key toggles between gross and net modes only.
SPLSIZ	**10** 20 50 100 5 PCWGT	Sample size. Specify the default size used for counting scale operations. Sample size can be changed in counting mode during sample acquisition.
ON/OFF	**ON** **OFF**	Turns the accumulator on and off.
RTZGRD	**0** **Number**	This is the number of grads from 0 that it has to return to re-arm the accumulator between weighments.
DATFMT	**MMDDYY** DDMMYY YYMMDD	Specifies the format used to display or print the date.
DATSEP	**SLASH** DASH SEMI	Specifies the date separator character
TIMFMT	**24HOUR** 12HOUR	Specifies the format used to display or print the time
TIMSEP	**COLAN** COMMA	Specifies the time separator character

Table 5-7. FEATURE Menu Parameters (Continued)

5.2.6 Accumulate Function

The accumulate function is used to add weight data to a register for later access by the user. The accumulator can keep a running total of weights entered by manually pressing the **PRINT** key when the accumulate function is enabled (**ON**). The accumulator will accumulate displayed weight values as long as the accumulate function is enabled and the user keeps pressing the **PRINT** key.

To display the accumulated weight, press and hold the **(MODE) GROSS/NET** key for three seconds. The value will be displayed for about 10 seconds. To clear the accumulator, press the **CLR** key twice while the accumulated value is being displayed.

Print Format Menu

See for information about custom print formatting.

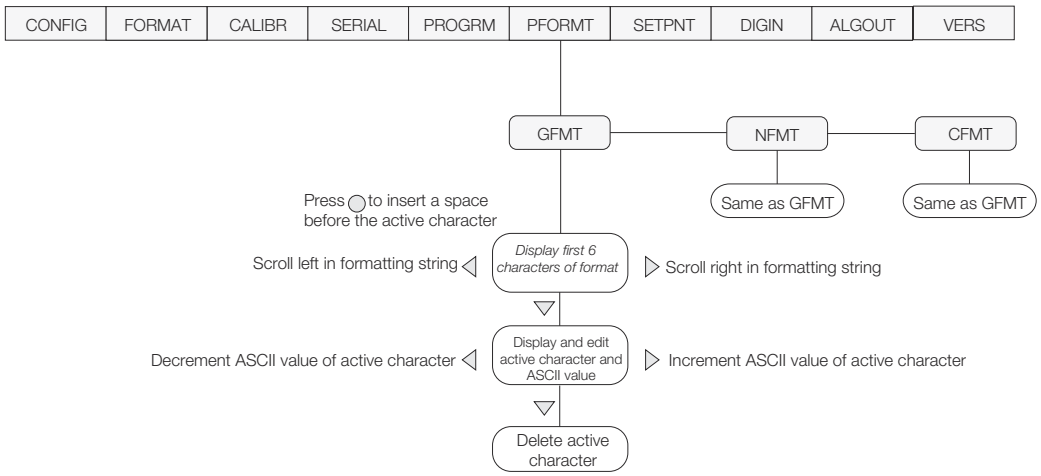


Figure 5-10. Print Format Menu

5.2.7 Setpoint Menu

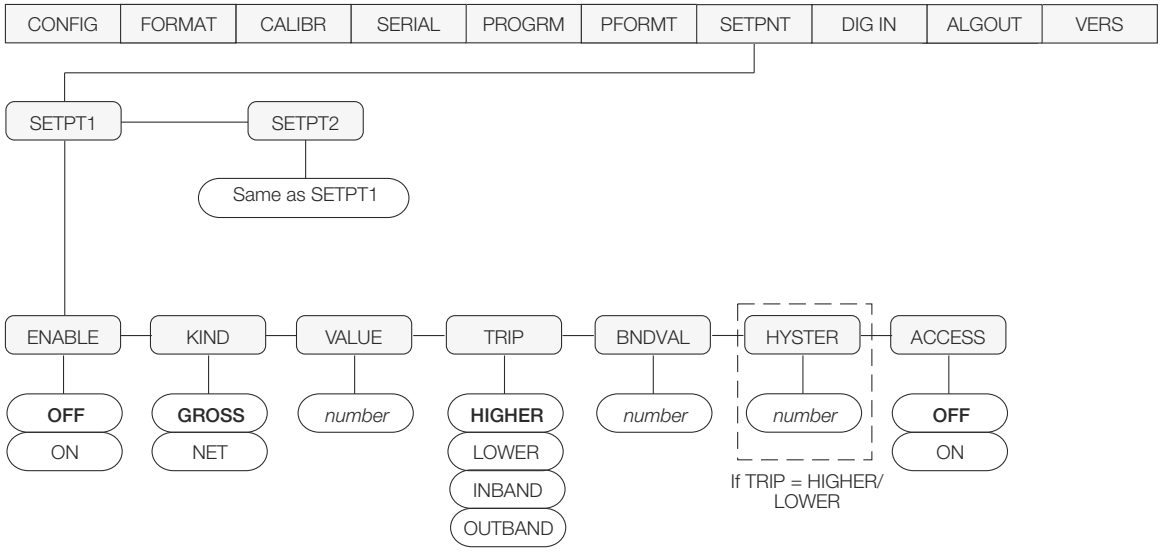


Figure 5-11. Setpoint Menu

Setpoint Menu		
Parameter	**Choices**	**Description**
Level 2 submenu		
SETPT1 SETPT2	ENABLE KIND VALUE TRIP BNDVAL	Specify settings for setpoint enable, kind, weight value, trip, and band value used by the setpoint.
Level 3 submenu		

Table 5-8. Setpoint Menu Parameters

Setpoint Menu		
Parameter	**Choices**	**Description**
ENABLE	**OFF** ON	Turn setpoint on or off.
KIND	**GROSS** NET	Specifies the setpoint kind and determines whether function is based on GROSS or NET weight. GROSS or NET setpoint kinds can be used.
VALUE	*number*	Display and edit the setpoint value.
TRIP	**HIGHER** LOWER INBAND OUTBND	Trips the setpoint when the weight is higher or lower than the setpoint value, or is within or outside of the band value. LOWER means the output is active until you reach weight. If trip is HIGHER, the output is active when the setpoint is met or exceeded. INBAND means the output is active if the weight is within the band value. If trip is OUTBND, the output is active when the weight is outside of the band value.
BNDVAL	*number*	The band value for either INBAND or OUTBND trip setpoints. BNDVAL is ignored unless trip is set to INBAND or OUTBND.
HYSTER	*number*	Specifies a band around the setpoint value that must be exceeded before the setpoint, once off, can trip on.
ACCESS	**OFF** ON	Front panel access to setpoints. Specify OFF if setpoints will not be tested. ON enables operator to turn setpoints on/off, change value, or change BANDVAL via front panel entry during weigh mode.

Table 5-8. Setpoint Menu Parameters (Continued)

5.2.8 Digital Input Menu

The DIG I/O menu shown in Figure 5-12 is used to assign functions to digital inputs.

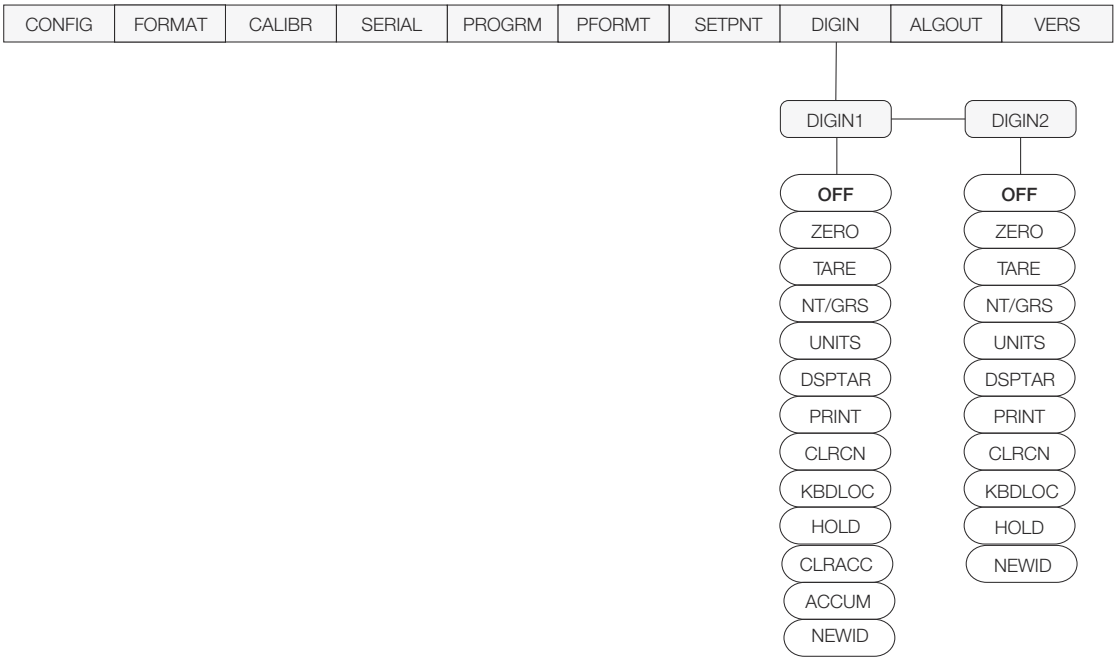


Figure 5-12. DIG I/O Menu

DIG IN Menu		
Parameter	**Choices**	**Description**
Level 2 submenu		
DIGIN1 DIGIN2	OFF ZERO TARE NT/GRS UNITS DSPTAR PRINT CLRCN KBDLOC HOLD CLRACC ACCUM NEWID	Specifies the function activated by digital inputs 1 and 2. • ZERO, NT/GRS (net/gross mode toggle), TARE, UNITS, and PRINT provide the same functions as the front panel keys. • DSPTAR displays the current tare value. • CLRCN resets the consecutive number to the value specified on the CONSTU parameter (PROGRM menu). • KBDLOC disables the keypad while the digital input is held low. • HOLD holds the current display. Releasing this input clears the running average filter. • CLRACC clears the accumulator • ACCUM displays the accumulator • NEWID enters the ID number.

Table 5-9. Digital Input Menu Parameters

5.2.9 Analog Output Menu

The ALGOUT menu is shown only if the analog output option is installed. If the analog output option is installed, configure all other indicator functions and calibrate the indicator itself before configuring the analog output.

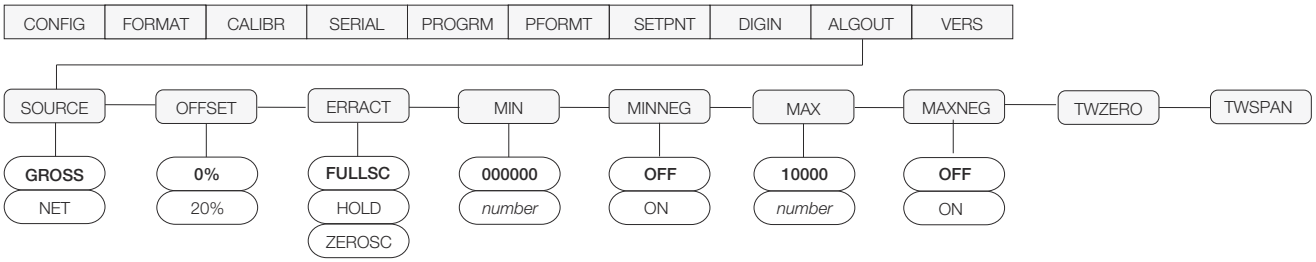


Figure 5-13. Analog Output Menu

ALG OUT Menu		
Parameter	**Choices**	**Description**
Level 2 submenus		
SOURCE	**GROSS** NET	Specifies the scale tracked by the analog output.
OFFSET	**0%** 20%	Zero offset. Select 0% for 0–10 V or 0–20 mA output; select 20% for 4–20 mA output. This parameter must be set before calibrating the analog output.
ERRACT	**FULLSC** HOLD ZEROSC	Error action. Specifies how the analog output responds to system error conditions. Possible values are: FULLSC: Set to full value (10 V or 20 mA) HOLD: Hold current value ZEROSC: Set to zero value (0 V or 4 mA)
MIN	**000000** *0–9999999*	Specifies the minimum weight value tracked by the analog output. Specify a value in the range 0–9999999.
MINNEG	**OFF** ON	Turn ON or OFF.
MAX	**10000** *0–9999999*	Specifies the maximum weight value tracked by the analog output. Specify a value in the range 0–9999999
MAXNEG	**OFF** ON	Turn ON or OFF.
TWZERO	_	Tweak zero. Enter tweak value to adjust the analog output zero calibration. Use a multimeter to monitor the analog output value.
TWSPAN	_	Tweak span. Enter tweak value to adjust the analog output span calibration. Use a multimeter to monitor the analog output value.

Table 5-10. Analog Output Menu Parameters

5.2.10 Version Menu

The VERS menu can be used to check the software version installed on the indicator. There are no parameters associated with the version menu; when selected, the indicator displays the installed software version number.

Figure 5-14. Version Menu

6.0 Calibration

While the functionality remains the same for a standard 420 digital weight indicator, there are certain menu choices that need to be changed in the manual that are specific to the proper functioning of the CLS-Series Cargo Lift Scale which include Calibration, Serial, Program, and Print Format.

The CLS-420 indicator can be calibrated using the front panel calibration procedure as explained in Section 6.1. This method consists of the following steps:

- Zeroing the scale inclinometer
- Zero calibration
- Entering the test weight value
- Calibration of cell #1
- Calibration of cell #2

The following sections describe the calibration procedure for each of the calibration methods.

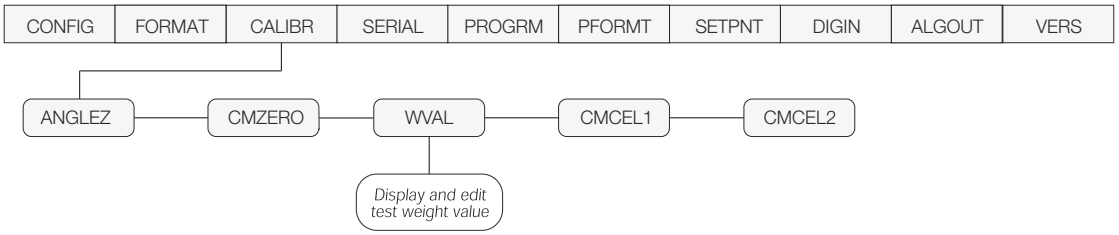


Figure 6-1. CLS-420 Calibration (CALIBR) Menu

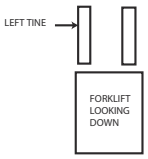
6.1 Front Panel Calibration

To calibrate the indicator, the forklift tines must be in place as test weights are placed upon them.

Use a level to ensure that the forklift tines are level prior to calibration.

The test weight used to calibrate the CLS-420 cannot be greater than 2500 lbs.

To calibrate the indicator using the front panel, do the following:

1. Place the 420 indicator in setup mode (display reads *CONFIG*).
2. Press ▷ until the display reads *CALIBR* (see Figure 6-1).
3. Use a level to level the forklift tines before pressing ▽ to go to *ANGLEZ*.
4. With *ANGLEZ* displayed and no weight on the forklift, press ○ to zero the scale inclinometer. *-CAL-* is briefly displayed on the indicator.
5. With *CMZERO* displayed press ○ to capture the lead load zero. *-CAL-* is displayed briefly on the indicator.
6. The indicator then asks for the *WVAL* (weight value). Enter the weight of the test weight to be used in the calibration procedure by pressing the enter key ○ and then keying in the weight value using the numeric keypad. Then press enter again.
7. *CMCEL1* is displayed.
8. Put the test weight on the left tine of the forklift 

and press ○. *-CAL-* is briefly displayed.
9. Once *-CAL-* is displayed, the indicator display automatically jumps to *CMCEL2*. Move test weight to the other tine. Press ○ and *-CAL-* is briefly displayed.
10. At this time the display says *-PASS-* or *-FAIL-*. If the display says *PASS*, it is followed by *CALIBR* and the calibration procedure is complete.
11. If the display says *-FAIL-*, then the display goes back to *CMZERO* and the calibration procedure must be started over.

7.0 Repair Parts List

Part #	Description
121014	iQube1 J-Box Assembly
130826	iQube1 J-Box with automatic quick disconnects
120999	Complete ABF version 420CLS indicator
120996	ABF Firmware
120997	420 CPU board with ABF special firmware installed
121006	WLAN reset switch assembly
121132	Replacement Ethernet cable and jack assembly
112323	Ethernet jack cover
121003	Mounting plate
121004	Angled Mounting Bracket
96198	SBM RL2000 FLS Load Cell
125543	SBM RL2000 FLS Load Cell with quick disconnects
96195	Power Cable Assembly

8.0 Appendix

8.1 Error Messages

The 420 indicator provides a number of error messages. When an error occurs, the message is shown on the indicator LED display.

8.1.1 Displayed Error Messages

The 420 provides a number of front panel error messages to assist in problem diagnosis. Table 8-1 lists these messages and their meanings.

Error Message	Description	Solution
E A/D	A/D physical error	Call Rice Lake Weighing Systems (RLWS) Service.
EEEROM	EEPROM physical error	
EVIREE	Virgin EEPROM	Use TEST menu to perform DEFLT (restore defaults) procedure, then recalibrate load cells.
EPCKSM	Parameter checksum error	
EACKSM	A/D calibration checksum error	A/D converter requires recalibration. Call RLWS Service.
EFCKSM	Printer format checksum error	Call RLWS Service.
ELCKSM	Load cell calibration checksum error	Recalibrate load cells.
EIDATA	Internal RAM checksum error	Call RLWS Service.
E REF	A/D reference error	A/D converter requires recalibration. Call RLWS Service.
ERROR	Internal program error	Check configuration. Run XE command (see Section 8.1.2 on page 41) to determine error type. Call RLWS Service if unable to clear error by cycling power or if error recurs.
OVERFL	Overflow error	Weight value too large to be displayed.
------	Gross > overload limit	Gross value exceeds overload limit. Check configuration or signal input level. Overload can be caused by input signal > 45 mV or common mode voltage > 950 mV.
_____	A/D underrange	A/D reading < –4 mV. Check scale for binding or damage.
RNGERR	GRADS > 100,000 WVAL > 100,000	Only shows up in Config mode.
NO COM	No communication with j-box	Check the cable or wireless connections or install a charged battery.
ERRSS	Serial Scale Error	Generic error. Need to troubleshoot system or call RLWS service.
----	Forks not level	Position forks within three degrees of level.
Wait	J-Box is powering up	This display is a normal action of the indicator.
LowBat	J-Box battery is getting low or dead. May not occur if completely dead.	Change battery.
ErrCell	J-Box is reporting a generic error	This is a declared error and should look at test mode to diagnose the problem.

Table 8-1. 420 Error Messages

8.1.2 Using the XE EDP Command

The XE EDP command can be used to remotely query the 420 for the error conditions shown on the front panel. The XE command returns two 5-digit numbers in the format:

xxxxx yyyyy

where *xxxxx* contains a decimal representation of any existing error conditions as described in Table 8-2.

If more than one error condition exists, the number returned is the sum of the values representing the error conditions. For example, if the XE command returns the number 1040, this value represents the sum of an A/D reference error (1024) and an A/D calibration checksum error (16).

The second number returned (*yyyyy*) uses the same bit assignments as shown in Table 8-2 to indicate whether the test for the error condition was run. For example, the value *yyyyy* = 50815 represents the decimal equivalent of the binary value 1100 0110 0111 1111. Using the bit assignments in Table 8-2, this value indicates all tests were run.

Error Code	Description	Binary Value
0x0001	EEPROM Error	0000 0000 0000 0001
0x0002	Virgin EEPROM	0000 0000 0000 0010
0x0004	Config Parameter Checksum	0000 0000 0000 0100
0x0008	Load Cell Checksum	0000 0000 0000 1000
0x0010	A/D Calibration Checksum	0000 0000 0001 0000
0x0020	Print Formats Checksum	0000 0000 0010 0000
0x0040	XA Internal RAM Error	0000 0000 0100 0000
0x0080	External RAM Error	0000 0000 1000 0000
0x0100	*Reserved*	0000 0001 0000 0000
0x0200	ADC Physical Error	0000 0010 0000 0000
0x0400	ADC Reference	0000 0100 0000 0000
0x0800	Count Error	0000 1000 0000 0000
0x1000	Reserved	0001 0000 0000 0000
0x2000	Display Range	0010 0000 0000 0000
0x4000	ADC Range	0100 0000 0000 0000
0x8000	Gross Limit	1000 0000 0000 0000
0x10000 - 0x80000000		*Reserved*

Table 8-2. Error Codes Returned on XE Command

8.2 Status Messages

Two EDP commands, P and ZZ, can be used to provide status about the indicator. These commands are described in the following sections.

8.2.1 Using the P EDP Command

The P EDP command returns the current displayed weight value to the EDP port, along with the units identifier. If the indicator is in an underrange or overload condition, the weight value is replaced with *&&&&&&* (overload) or*::::::* (underrange).

8.2.2 Using the ZZ EDP Command

The ZZ EDP command can be used to remotely query which annunciators are currently displayed on the indicator front panel. The ZZ command returns the currently displayed weight and a decimal number representing the LED annunciators currently lit. The format of the returned data is:

wwwwww uu zzz

where *wwwwww uu* is the current displayed weight and units, *zzz* is the annunciator status value (see Table 8-3). If more than one annunciator is lit, the second number returned is the sum of the values representing the active annunciators.

Example: If the annunciator status value returned on the ZZ command is 145, the gross, standstill, and lb annunciators are lit. 145 represents the sum of the values for the standstill annunciator (128), gross mode annunciator (16), and the lb/primary units annunciator (1).

Decimal Value	Annunciator
1	lb/primary units
2	kg/secondary units
16	Gross
32	Net
64	Center of zero
128	Standstill

Table 8-3. Status Codes Returned on the ZZ Command

8.3 Continuous Output (Stream) Format

Figure 8-1 shows the continuous output format sent to the 420 printer port when the STREAM parameter (SERIAL menu) is set to either EDP or PRN.

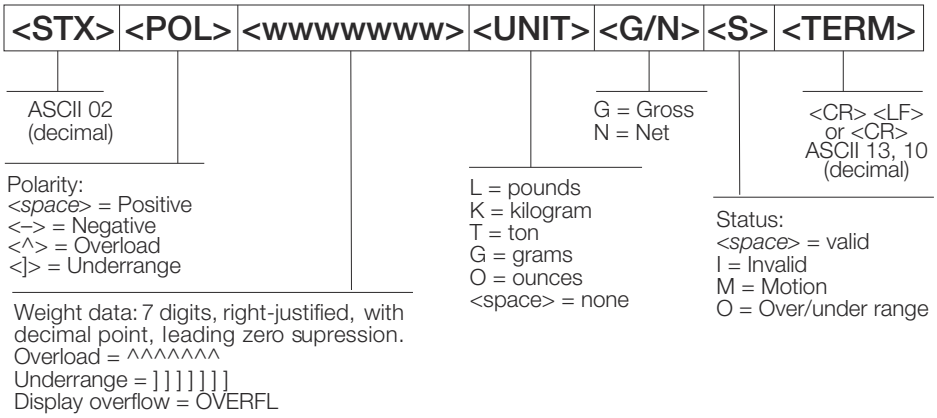


Figure 8-1. Continuous Output Data Format

8.4 ASCII Character Chart

Use the decimal values for ASCII characters listed in Tables 8-4 and 8-5 when specifying print format strings on the 420 PFORMT menu. The actual character printed depends on the character mapping used by the output device.

The 420 can send or receive any ASCII character value (decimal 0–255), but the indicator display is limited to numbers, upper-case, unaccented letters, and a few special characters. See Section 8.5 on page 45 for information about the 420 LED display.

Control	ASCII	Dec	Hex	ASCII	Dec	Hex	ASCII	Dec	Hex	ASCII	Dec	Hex
Ctrl-@	NUL	00	00	space	32	20	@	64	40	`	96	60
Ctrl-A	SOH	01	01	!	33	21	A	65	41	a	97	61
Ctrl-B	STX	02	02	“	34	22	B	66	42	b	98	62
Ctrl-C	ETX	03	03	#	35	23	C	67	43	c	99	63
Ctrl-D	EOT	04	04	$	36	24	D	68	44	d	100	64
Ctrl-E	ENQ	05	05	%	37	25	E	69	45	e	101	65
Ctrl-F	ACK	06	06	&	38	26	F	70	46	f	102	66
Ctrl-G	BEL	07	07	’	39	27	G	71	47	g	103	67
Ctrl-H	BS	08	08	(	40	28	H	72	48	h	104	68
Ctrl-I	HT	09	09	)	41	29	I	73	49	i	105	69
Ctrl-J	LF	10	0A	*	42	2A	J	74	4A	j	106	6A
Ctrl-K	VT	11	0B	+	43	2B	K	75	4B	k	107	6B
Ctrl-L	FF	12	0C	,	44	2C	L	76	4C	l	108	6C
Ctrl-M	CR	13	0D	-	45	2D	M	77	4D	m	109	6D
Ctrl-N	SO	14	0E	.	46	2E	N	78	4E	n	110	6E
Ctrl-O	SI	15	0F	/	47	2F	O	79	4F	o	111	6F
Ctrl-P	DLE	16	10	0	48	30	P	80	50	p	112	70
Ctrl-Q	DC1	17	11	1	49	31	Q	81	51	q	113	71
Ctrl-R	DC2	18	12	2	50	32	R	82	52	r	114	72
Ctrl-S	DC3	19	13	3	51	33	S	83	53	s	115	73
Ctrl-T	DC4	20	14	4	52	34	T	84	54	t	116	74
Ctrl-U	NAK	21	15	5	53	35	U	85	55	u	117	75
Ctrl-V	SYN	22	16	6	54	36	V	86	56	v	118	76
Ctrl-W	ETB	23	17	7	55	37	W	87	57	w	119	77
Ctrl-X	CAN	24	18	8	56	38	X	88	58	x	120	78
Ctrl-Y	EM	25	19	9	57	39	Y	89	59	y	121	79
Ctrl-Z	SUB	26	1A	:	58	3A	Z	90	5A	z	122	7A
Ctrl-[	ESC	27	1B	;	59	3B	[	91	5B	{	123	7B
Ctrl-\	FS	28	1C	<	60	3C	\	92	5C	|	124	7C
Ctrl-]	GS	29	1D	=	61	3D	]	93	5D	}	125	7D
Ctrl-^	RS	30	1E	>	62	3E	^	94	5E	~	126	7E
Ctrl-_	US	31	1F	?	63	3F	_	95	5F	DEL	127	7F

Table 8-4. ASCII Character Chart (Part 1)

ASCII	Dec	Hex	ASCII	Dec	Hex	ASCII	Dec	Hex	ASCII	Dec	Hex
Ç	128	80	á	160	A0		192	C0	α	224	E0
ü	129	81	í	161	A1		193	C1	ß	225	E1
é	130	82	ó	162	A2		194	C2	Γ	226	E2
â	131	83	ú	163	A3		195	C3	π	227	E3
ä	132	84	ñ	164	A4		196	C4	Σ	228	E4
à	133	85	Ñ	165	A5		197	C5	σ	229	E5
å	134	86	ª	166	A6		198	C6	µ	230	E6
ç	135	87	º	167	A7		199	C7	τ	231	E7
ê	136	88	¿	168	A8		200	C8	Φ	232	E8
ë	137	89		169	A9		201	C9	Θ	233	E9
è	138	8A	¬	170	AA		202	CA	Ω	234	EA
ï	139	8B	1/2	171	AB		203	CB	δ	235	EB
î	140	8C	1/4	172	AC		204	CC	∞	236	EC
ì	141	8D	¡	173	AD		205	CD	ϕ	237	ED
Ä	142	8E	«	174	AE		206	CE	∈	238	EE
Å	143	8F	»	175	AF		207	CF	∩	239	EF
É	144	90		176	B0		208	D0	≡	240	F0
æ	145	91		177	B1		209	D1	±	241	F1
Æ	146	92		178	B2		210	D2	≥	242	F2
ô	147	93		179	B3		211	D3	≤	243	F3
ö	148	94		180	B4		212	D4	⌠	244	F4
ò	149	95		181	B5		213	D5	⌡	245	F5
û	150	96		182	B6		214	D6	÷	246	F6
ù	151	97		183	B7		215	D7	≈	247	F7
ÿ	152	98		184	B8		216	D8	°	248	F8
Ö	153	99		185	B9		217	D9	•	249	F9
Ü	154	9A		186	BA		218	DA		250	FA
¢	155	9B		187	BB		219	DB		251	FB
£	156	9C		188	BC		220	DC		252	FC
¥	157	9D		189	BD		221	DD	²	253	FD
Pts	158	9E		190	BE		222	DE		254	FE
ƒ	159	9F		191	BF		223	DF		255	FF

Table 8-5. ASCII Character Chart (Part 2)

8.5 Front Panel Display Characters

Figure 8-2 shows the 7-segment LED character set used to display alphanumeric characters on the 420 front panel.

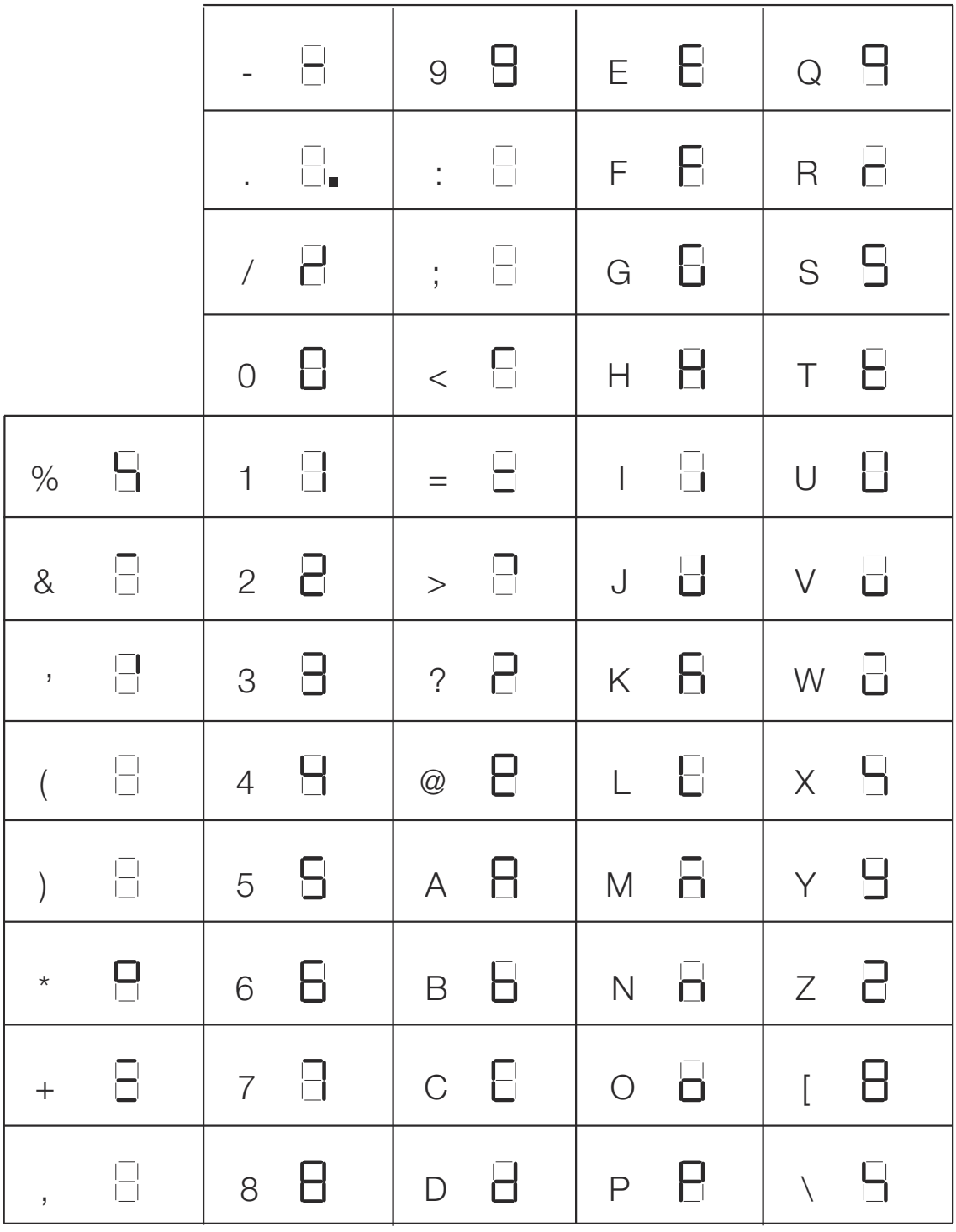


Figure 8-2. 420 *Display Characters*

8.6 Conversion Factors for Secondary Units

The 420 has the capability to mathematically convert a weight into many different types of units and instantly display those results with a press of the **UNITS** key.

Secondary units can be specified on the FORMAT menu using the SECNDR parameter, or by using EDP commands.

NOTES:

- Multipliers are preconfigured within the indicator. Manual entry is only necessary when NONE is selected under UNITS. Long tons and grain units listed in Table 8-6 cannot be directly specified as primary or secondary units. For these or other unlisted units of weight, specify NONE under UNITS.
- Ensure that the secondary decimal point position is set appropriately for the scale capacity in the secondary units. If the converted value requires more digits than are available, the indicator will display an overflow message (*OVERFL*).
- For example, if the primary units are short tons, secondary units are pounds, and the secondary decimal point is set to 8888.88, the indicator will overflow if 5 tons or more are applied to the scale. With 5 tons applied, and a conversion factor of 2000, the secondary units display needs five digits to the left of the decimal point to display the 10000 lb secondary units value.

Primary Unit	*x Multiplier*	Secondary Unit
grains	0.064799	grams
	0.002286	ounces
	0.000143	pounds
	0.000065	kilograms
ounces	437.500	grains
	28.3495	*grams*
	0.06250	*pounds*
	0.02835	*kilograms*
pounds	7000.00	grains
	453.592	*grams*
	16.0000	*ounces*
	0.453592	*kilograms*
	0.000500	*short tons*
	0.000446	long tons
	0.000453	*metric tons*
short tons	*2000.00*	*pounds*
	907.185	*kilograms*
	0.892857	long tons
	0.907185	*metric tons*
grams	15.4324	grains
	0.035274	*ounces*
	0.002205	*pounds*
	0.001000	*kilograms*
kilograms	15432.4	grains
	35.2740	*ounces*
	1000.00	*grams*
	2.20462	*pounds*
	0.001102	*short tons*
	0.000984	long tons
	0.001000	*metric tons*
metric tons	*2204.62*	*pounds*
	1000.00	*kilograms*
	1.10231	*short tons*
	0.984207	long tons
long tons	*2240.00*	*pounds*
	1016.05	*kilograms*
	1.12000	*short tons*
	1.01605	*metric tons*
NOTE: Multipliers in italics are preconfigured		

Table 8-6. Conversion Factors

8.7 Digital Filtering

The 420 uses averaged digital filtering to reduce the effect of vibration on weight readings. Adjustable threshold and sensitivity functions allow quick settling by suspending filter averaging, allowing the weight reading to jump to the new value. Figure 8-3 shows the digital filter parameters on the CONFIG menu.

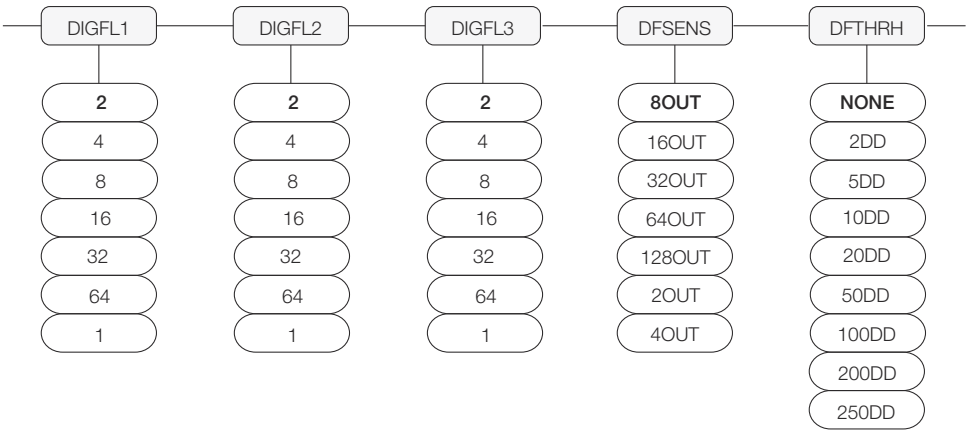


Figure 8-3. Digital Filtering Parameters on the Configuration (CONFIG) Menu

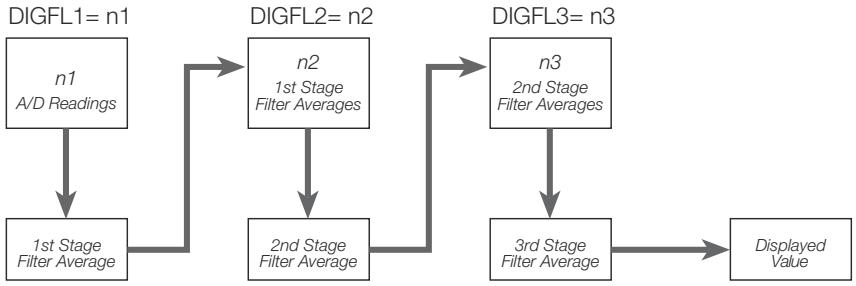


Figure 8-4. Flow Diagram for 420 *Digital Filters*

8.7.1 DIGFLx Parameters

The first three digital filtering parameters, DIGFL1, DIGFL2, and DIGFL3, are configurable filter stages that control the effect of a single A/D reading on the displayed weight. The value assigned to each parameter sets the number of readings received from the preceding filter stage before averaging (see Figure 8-4).

The overall filtering effect can be expressed by adding the values assigned to the three filter stages:

DIGFL1 + DIGFL2 + DIGFL3

For example, if the filters are configured as DIGFL1=4, DIGFL2=8, DIGFL3=8, the overall filtering effect is 20 (4 + 8 + 8). With this configuration, each A/D reading has a 1-in-20 effect on the displayed weight value. Setting the filters to 1 effectively disables digital filtering.

8.7.2 DFSENS and DFTHRH Parameters

The three digital filters can be used by themselves to eliminate vibration effects, but heavy filtering also increases settling time. The DFSENS (digital filter sensitivity) and DFTHRH (digital filter threshold) parameters can be used to temporarily override filter averaging and improve settling time:

- DFSENS specifies the number of consecutive scale readings that must fall outside the filter threshold (DFTHRH) before digital filtering is suspended.
- DFTHRH sets a threshold value, in display divisions. When a specified number of consecutive scale readings (DFSENS) fall outside of this threshold, digital filtering is suspended. Set DFTHRH to NONE to turn off the filter override.

8.7.3 Setting the Digital Filter Parameters

Fine-tuning the digital filter parameters greatly improves indicator performance in heavy-vibration environments. Use the following procedure to determine vibration effects on the scale and optimize the digital filtering configuration.

1. In setup mode, set all three digital filters (DIGFL1, DIGFL2, DIGFL3) to 1. Set DFTHRH to NONE. Return indicator to normal mode.
2. Remove all weight from the scale, then watch the indicator display to determine the magnitude of vibration effects on the scale. Record the weight below which all but a few readings fall. This value is used to calculate the DFTHRH parameter value in Step 4.

   For example, if a heavy-capacity scale produces vibration-related readings of up to 50 lb, with occasional spikes to 75 lb, record 50 lb as the threshold weight value.
3. Place the indicator in setup mode and set the digital filters (DIGFL*x*) to eliminate the vibration effects on the scale. (Leave DFTHRH set to NONE.) Reconfigure as necessary to find the lowest effective values for the DIGFL*x* parameters.
4. With optimum values assigned to the DIGFL*x* parameters, calculate the DFTHRH parameter value by converting the weight value recorded in Step 2 to display divisions:

   threshold_weight_value / DSPDIV

   In the example in Step 2, with a threshold weight value of 50 lb and a display division value of 5lb: *50 / 5lb = 10DD*. DFTHRH should be set to 10DD for this example.
5. Finally, set the DFSENS parameter high enough to ignore transient peaks. Longer transients (typically caused by lower vibration frequencies) will cause more consecutive out-of-band readings, so DFSENS should be set higher to counter low frequency transients.

   Reconfigure as necessary to find the lowest effective value for the DFSENS parameter.

8.8 Analog Output Calibration

The following calibration procedure requires a multimeter to measure voltage or current output from the analog output module.

Note** **The analog output must be calibrated after the indicator itself has been configured (Section 5.0) and calibrated (Section 6.0).

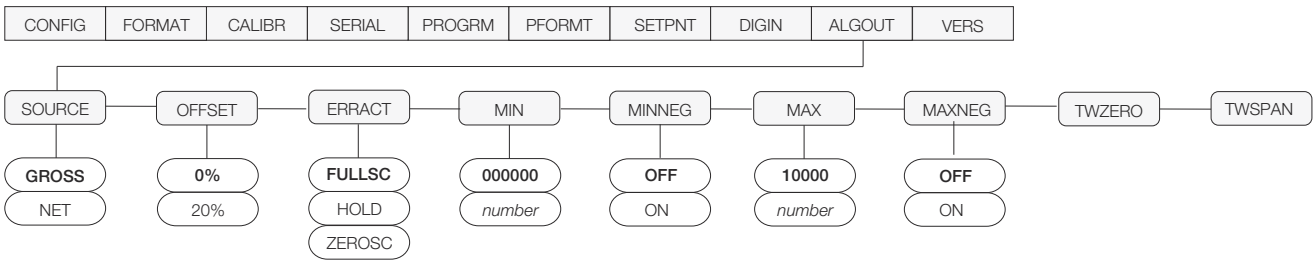


Figure 8-5. Analog Output Menu

1. Enter setup mode and go to the ALGOUT menu (see Figure 8-5).
   - Set OFFSET to 0% for 0–10 V output, 20% for 4–20 mA output
   - Set MIN to lowest weight value to be tracked by the analog output
   - Set MAX to highest weight value to be tracked by the analog output
2. Connect multimeter to analog output:
   - For voltage output, connect voltmeter leads to pins three and four
   - For current output, connect ammeter leads to pins one and two
3. Adjust zero calibration: Scroll to the TWZERO parameter. Check voltage or current reading on multimeter. Press and hold △ or ▽ to adjust the zero value up or down.
4. Adjust span calibration: Scroll to the TWSPAN parameter. Check voltage or current reading on multimeter. Press and hold △ or ▽ to adjust the span value up or down.
5. Final zero calibration: Return to the TWZERO parameter and verify that the zero calibration has not drifted. Press and hold △ or ▽ to re-adjust the zero value as required.
6. Return to normal mode. Analog output function can be verified using test weights.

8.9 Test Mode

***Note** Test mode is intended for factory use only.*

In addition to normal and setup modes, test mode provides a number of diagnostic functions for the *920i*, including:

- Display raw A/D count
- Reset configuration parameters to default values
- A/D internal calibration

To enter test mode, press and hold the setup switch until the front panel display shows the word *TEST*. After about three seconds, the test mode display automatically shifts to the first test menu function, A/DTST.

Figure 8-6 shows the Test Menu structure; Figure 8-7 shows the front panel key functions in test mode. Note that, because the Test Menu functions are all on a single menu level, the **GROSS/NET** (▽) key has no function. Press the **ZERO** (△) key to exit test mode.

Table 8-7 summarizes the test menu functions.

Figure 8-6. Test Mode Menu

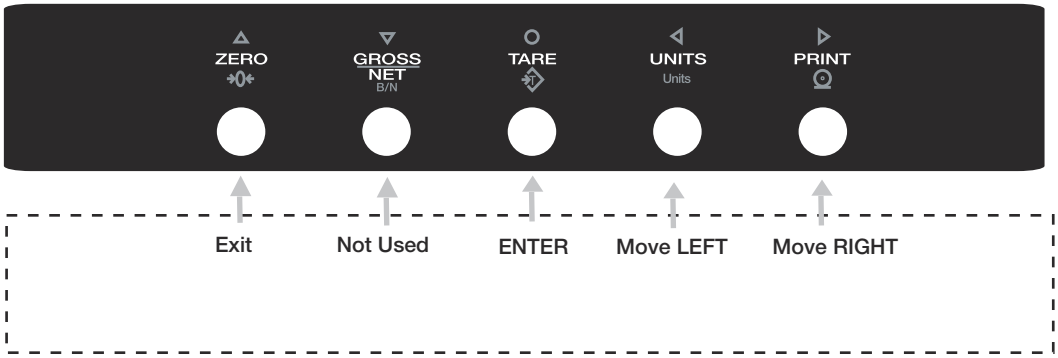


Figure 8-7. Front Panel Key Functions in Test Mode

TEST Menu	
Function	**Description**
A/DTST	Display A/D test Press and hold Enter key to display raw count from A/D converter.
DEFLT	Default parameters Press setup switch and Enter key at the same time to reset configuration and calibration parameters to factory default values. Load cells must be recalibrated before using the indicator (see Section 6.0 on page 38).

Table 8-7. Test Mode Menu Functions

8.10 Regulatory Mode Functions

REGULAT Parameter Value	Weight on Scale	Tare in System	Front Panel Key Function	
			TARE	ZERO
NTEP	zero or negative	no	no action	ZERO
		yes	CLEAR TARE	
	positive	no	TARE	
		yes	TARE	
CANADA	zero or negative	no	no action	TARE
		yes	CLEAR TARE	
	positive	no	TARE	
		yes	no action	
OIML	zero or negative	no	no action	ZERO
		yes	CLEAR TARE	ZERO and CLEAR TARE
	positive	no	TARE	ZERO
		yes	TARE	ZERO and CLEAR TARE
NONE	zero or negative	no	TARE	ZERO
		yes	CLEAR TARE	
	positive	no	TARE	
		yes	CLEAR TARE	

Table 8-8. TARE and ZERO Key Functions for REGULAT Parameter Settings

8.11 LED Functions

The following is a list of diagnostic LEDs for the 420. See Figure 1.3.2 5 for locations on the 420 CPU board.

Serial Port Status

LED1 (EDP Port)	Flashing red = TXD activity
	Flashing green = RXD activity
	On steady or off = No activity
LED2 (PRN Port)	Flashing red = TXD activity
	Flashing green = RXD activity
	On steady or off = No activity

Power Supply

LED (+5AV)	Excitation/ADC supply on
LED (+5V & +3.3V)	Digital logic supply on

Operation Status

LEDHB (Microprocessor)	Flashing green = Active
	Red = Fault
LED AD (ADC)	Green = Active
	Red = Fault
LED MEM (Memory Test)	Green = Pass
	Red = Fail
LED ANA (Analog Option Card)	Red = Not Implemented

Digital Input/Output Status

DO 1 (Digital Out 1)	On when lit (active low)
DO 2 (Digital Out 2)	On when lit (active low)
DI 1 (Digital In 1)	On when lit (active low)
DI 2 (Digital In 2)	On when lit (active low)

8.12 420 Indicator Specifications

Power - DC Voltage

DC Line Voltages	9-36 VDC Input
Power Consumption	1.5 A
Fusing	Internal short circuit protection 2.5 A 5 x 20 mm fuse

Analog Specifications

Full Scale Input Signal	Up to 22.5 mV
Excitation Voltage	+5V single sided 8 x 350Ω or 16 x 700Ω load cells
Sense Amplifier	Differential amplifier with 4- and 6-wire sensing
Analog Signal Input Range	–0.5 mV/V to +4.5 mV/V
Analog Signal Sensitivity	0.3 μV/graduation minimum, 1.5 μV/grad recommended
Input Impedance	200 MΩ, typical
Noise (ref to input)	0.3 μV p-p with digital filters at 4-4-4
Internal Resolution	8,000,000 counts
Display Resolution	100 000 dd
Measurement Rate	Up to 60 measurements/sec
Input Sensitivity	10 nV per internal count
System Linearity	Within 0.01% of full scale
Zero Stability	150 nV/°C, maximum
Span Stability	3.5 ppm/°C, maximum
Calibration Method	Software, constants stored in EEPROM
Common Mode Voltage	–2.35 to +3.45 V, referred to ground
Common Mode Rejection	130 dB minimum @ 50 or 60 Hz
Normal Mode Rejection	90 dB minimum @ 50 or 60 Hz
Input Overload	± 12 V continuous, static discharge protected
RFI Protection	Signal, excitation, and sense lines protected by capacitor bypass
Analog Output	Optional: fully isolated, voltage or current output,14-bit resolution. Voltage output: 0 –10 VDC Load resistance:1KΩ minimum Current output: 0–20/4–20 mA External loop resistance: 500Ω maximum

Digital Specifications

Microcomputer	Phillips PXAG30K main processor @ 19.6608 MHz
Digital Inputs	2 inputs, TTL or switch closure, active-low
Digital Outputs	2 outputs, 250 mA Max Sink
Digital Filters	3 filters, software selectable

Serial Communications

EDP Port	dedicated to two channel iQube communication
Printer Port	Full duplex RS-232 or active transmit only 20 mA current loop
Both Ports	38400, 19200, 9600, 4800, 2400, 1200, 600, 300 bps; 7 or 8 data bits; even, odd, or no parity

Operator Interface

Display	6-digit LED display. 7-segment, 1.8 in (44.5 mm) digits
LED annunciators	Gross, net, center of zero, standstill, lb/ primary units, kg/secondary units, count, tare
Keypad	21-button keypad

Environmental

Operating Temperature	–10 to +40°C (legal); –10 to +50°C (industrial)
Storage Temperature	–25 to +70°C
Humidity	0–95% relative humidity

Enclosure

Enclosure Dimensions	10.5 in x 12.5 in x 6.4 in 26.7 cm x 31.75 cm x 16.3 cm
Weight	7.8 lb. (3.54 Kg)
Rating/Material	UL Type 4X

Certifications and Approvals

NTEP

CoC Number	04-076
Accuracy Class	III/III L n_{max}: 10 000

Measurement Canada (Pending)

Accuracy Class	III/III HD n_{max}: 10 000

Daily Inspection Checklist For Lift Truck Scale Users

- ☐ Check scale carriage for loose, worn, bent or broken components.
- ☐ Inspect fork tines for damage.
- ☐ Check locking pins on fork tines.
- ☐ Inspect coiled cable for pinched, rubbed, stretched or damaged areas.
- ☐ Inspect power cable from indicator to battery for nicks or cuts.
- ☐ Make sure power cable is routed out of harms way, fasten periodically to eliminate potential problems.
- ☐ Tighten cable connections at indicator j-box if necessary.
- ☐ Inspect coiled cable clamps and cable ties to be sure all cable attachments are secure.
- ☐ Inspect indicator mounting bracket, isolation mounts and hardware for loose or cracked parts.
- ☐ Tighten bottom clamps on scale carriage if necessary. Raise carriage and visually inspect.
- ☐ Check and adjust the lift chain so the heel of the forks have 1/2” to 1” of clearance from floor when the carriage is down and the mast is vertical.

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